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**CMA Part 1**  
**Volume 1: Sections A – C**

**Financial Reporting, Planning,  
Performance, and Control**

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**Sixth Edition**  
**CMA**  
**Preparatory Program**

**Part 1**  
**Volume 1: Sections A – C**

**Financial Reporting, Planning,  
Performance, and Control**

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## **Editorial Notes**

Throughout these materials, we have chosen particular language, spellings, structures and grammar in order to be consistent and comprehensible for all readers. HOCK study materials are used by candidates from countries throughout the world, and for many, English is a second language. We are aware that our choices may not always adhere to “formal” standards, but our efforts are focused on making the study process easy for all of our candidates. Nonetheless, we continue to welcome your meaningful corrections and ideas for creating better materials.

This material is designed exclusively to assist people in their exam preparation. No information in the material should be construed as authoritative business, accounting or consulting advice. Appropriate professionals should be consulted for such advice and consulting.

**Dear Future CMA:**

Welcome to HOCK *international*! You have made a wonderful commitment to yourself and your profession by choosing to pursue this prestigious credential. The process of certification is an important one that demonstrates your skills, knowledge and commitment to your work.

We are honored that you have chosen HOCK as your partner in this process. We know that this is a great responsibility, and it is our goal to make this process as painless and efficient as possible for you. To do so, HOCK has developed the following tools for your use:

- **A Study Plan** that guides you, week by week, through the study process. You can also create a personalized study plan online to adapt the plan to fit your schedule. Your personalized plan can also be emailed to you at the beginning of each week.
- **The Textbook** that you are currently reading. This is your main study source and contains all of the information necessary to pass the exam. This textbook follows the exam contents and provides all necessary background information so that you don't need to purchase or read other books.
- **The Flash Cards** include short summaries of main topics, key formulas and concepts. You can use them to review whenever you have a few minutes, but don't want to take your textbook along.
- **ExamSuccess** contains original questions and questions from past exams that are relevant to the current syllabus. Answer explanations for the correct and incorrect answers are also included for each question.
- **Practice Questions** taken from past CMA Exams that provide the opportunity to practice the essay-style questions on the Exam.
- **A Mock Exam** enables you to make final preparations using questions that you have not seen before.
- **Teacher Support** via our online student forum, e-mail, and telephone throughout your studies to answer any questions that may arise.
- **HOCK Classroom** with video and audio recordings of classes conducted and taught by HOCK lecturers. With the Classroom you are able to have the benefits of attending classes without actually being required to be near a location where classes are held.

We understand the commitment that you have made to the exams, and we will match that commitment in our efforts to help you. Furthermore, we understand that your time is too valuable to study for an exam twice, so we will do everything possible to make sure that you pass the first time.

I wish you success in your studies, and if there is anything I can do to assist you, please contact me directly at [brian.hock@hockinternational.com](mailto:brian.hock@hockinternational.com).

Sincerely,

Brian Hock, CMA, CIA

President and CEO

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## Introduction to CMA Part 1

The Part 1 Exam has five sections included in the Learning Outcome Statements. The five sections and their approximate weights on the exam are:

- 1) External Financial Reporting Decisions: 15%
- 2) Planning, Budgeting and Forecasting: 30%
- 3) Performance Management: 20%
- 4) Cost Management: 20%
- 5) Internal Controls: 15%

The Learning Outcome Statements (LOS) for both exam parts are available to download on the IMA's website at [www.imanet.org](http://www.imanet.org).

The questions on the exams focus on understanding, in-depth thinking on business strategy, and problem-solving ability, not just number crunching. In order to be able to think your way through the questions on the exam, you will need to understand the concepts and be able to apply them to situations that are new to you. We can give you the tools for understanding in these study materials, but we cannot teach you in-depth thinking and problem solving. Your ability to put this information into practice to pass this exam will depend on you and the effort you put into preparing for the exam.

**Note:** The CMA exams assume that candidates have a prerequisite knowledge of economics, statistics, and external financial reporting. Therefore, you may find that you will need some additional background information as you work through this material. HOCK has put together a two-volume *Assumed Knowledge* book where we have included this background information.

**Both** volumes of the *Assumed Knowledge* book contain background information that may be needed for **both** CMA exams. In other words, Volume 1 of the *Assumed Knowledge* book is **not** limited to information that is required for the Part 1 exam, and Volume 2 is **not** limited to information that is required for the Part 2 exam. Instead, the *Assumed Knowledge* book is organized according to topic: Volume 1 contains economics and statistics, and Volume 2 contains external financial reporting, all of which is assumed knowledge for both CMA exams.

Section A, *External Financial Reporting Decisions*, represents 15% of the exam. The information provided through financial accounting and reporting should be useful to individuals who are using the information to make decisions about the future direction of the business. Although knowledge of external financial reporting is assumed, Section A covers external financial reporting from the perspective of its use in decision-making. The differences between U.S. GAAP and IFRS are an important part of Section A.

Section B, *Planning, Budgeting and Forecasting*, represents 30% of the exam and is the largest part of the exam in terms of weight. Planning, budgeting, and forecasting are very important skills for the CMA, and this section should be one of the areas you focus on in your preparation.

Section C, *Performance Management*, is 20% of the exam. Section C covers variance analysis and responsibility accounting as well as financial performance measures. For variances, you need to be able to both calculate the variances and interpret the information that you get through variance analysis. In addition to memorizing the variance formulas, you will need to be able to understand and interpret the results of each variance calculation.

Section D, *Cost Management*, is also 20% of the exam. Section D focuses on costing systems and covers a number of methods of allocating costs and overheads. It also covers supply chain management and business process improvement.

Section E, *Internal Controls*, represents 15% of the exam. The fact that it represents "only" 15% of the exam does not mean you can ignore it. The technicalities of internal controls are important to know, especially the relevant laws that businesses are subject to and the related guidance that has been published. The Sarbanes-Oxley Act has had effects that are far reaching, and you should be familiar with its requirements.

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## Section A – External Financial Reporting Decisions

Financial accounting is the process of reporting the results and effects of the financial transactions that a business undertakes. The objective of financial reporting is to provide financial information about the entity that is useful for decision-making. Those using the financial information to make decisions include present and potential equity investors, lenders, and other creditors who need to make decisions about providing resources to the entity. The decisions relate to buying, selling, or holding debt or equity instruments and providing credit. In order to make these decisions, investors, lenders and other creditors need information that will help them assess the amount of, timing of, and prospects for future net cash inflows to the entity.<sup>1</sup>

Other users who may or may not be providing capital to the firm, such as management, employees, financial analysts and regulators find the financial statements useful, as well.

The types of decisions that these individuals are making are numerous and varied. It is not possible for accounting information to provide all of the necessary information that users need to make their decisions. Users need to access information from other sources, as well, such as economic forecasts, the political climate, and industry outlooks.<sup>2</sup> However, the financial statements do attempt to provide as much useful information as possible to the users.

### Financial Statements

#### Users of Financial Information

Published financial information must be in compliance with the established accounting guidelines because outside users will rely on it to make a variety of decisions. These rules and standards are in place to protect outside users by ensuring that the information is accurate and useful and can be understood by everyone.

Because so many people are using the financial information and they are using it for so many diverse purposes, the reasons that people need the financial information are also diverse, such as to:

- Make investment decisions.
- Extend credit or not.
- Assess areas of strength and weakness within the company.
- Evaluate performance of management.
- Determine whether or not the company is in compliance with regulatory requirements.

Users of financial information can be classified by various distinctions:

**Direct vs. Indirect Users** – Direct users are those who are directly affected by the results of a company. Direct users include investors and potential investors, employees, management, suppliers and creditors. Direct users are individuals who stand to lose money financially if the company has financial problems.

Indirect users are those people or groups who represent direct users. They include financial analysts and advisors, stock markets and regulatory bodies.

**Internal vs. External** – Internal users make decisions within the firm whereas external users make decisions from outside of the firm about whether or not to begin a relationship with the firm, continue a relationship with the firm, or change their relationship to the firm.

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<sup>1</sup> FASB Statement of Concepts No. 8 issued September 2010, Chapter 1, paragraph OB3.

<sup>2</sup> FASB Statement of Concepts No. 8 issued September 2010, Chapter 1, paragraph OB6.

**Note:** Users of financial statements are assumed to have a **reasonable knowledge** of business and economic activities and to be willing to study the information with **reasonable diligence**. This is an important assumption because it means in the preparation of financial statements, a **reasonable level** of competence on the part of users can be assumed. Someone who has a reasonable understanding of business, accounting and economic activities should be able to read the financial information that is presented and understand it.

## The Financial Statements

The five financial statements used under U.S. GAAP are:

- Balance Sheet (also called the Statement of Financial Position).
- Income Statement.
- Statement of Cash Flows.
- Statement of Comprehensive Income.
- Statement of Changes in Stockholders' Equity.

**Note:** The notes to the financial statements are also considered an integral part of the financial statements but are not an actual financial statement. The purpose of the notes is to provide informative disclosures that are required by GAAP.

**Note:** A company can also prepare **prospective financial statements**. Prospective financial statements are financial statements that are based on a set of assumptions and cover a future period. Whenever prospective financial statements are prepared, the **significant accounting policies** and **significant assumptions** that were made need to be disclosed. Prospective financial statements can also be called **pro forma** financial statements.

## The Balance Sheet

The balance sheet, also called a **statement of financial position**, provides information about an entity's assets, liabilities and owners' equity **at a point in time**. The statement shows the entity's resource structure—the major classes and amounts of assets—and its financing structure—the major classes and amounts of liabilities and equity.<sup>3</sup> The balance sheet is a picture of what the company owns and owes **at a particular point in time** (usually the end of a reporting period).

The balance sheet presents assets, liabilities, and equity in what is called the **proprietary theory**. The proprietary theory means that net assets are viewed as belonging to the owner(s) or proprietor(s).

A balance sheet is not intended to show the value of a business. However, along with other financial statements and other information, a balance sheet should provide information that will be useful to someone who wants to make his or her own estimate of the business's value.<sup>4</sup>

Balance sheet accounts are **permanent accounts**. They are not closed out at the end of each accounting period but rather their balances are cumulative. They keep on accumulating transactions and changing with each transaction, year after year.

<sup>3</sup> FASB Statement of Concepts No. 5, *Recognition and Measurement in Financial Statements of Business Enterprises*, Paragraph 26.

<sup>4</sup> FASB Statement of Concepts No. 5 issued December 1984, paragraph 27.

### Elements of the Balance Sheet

Elements of the balance sheet include assets, liabilities, and stockholders' (or owners') equity.

**Assets** are probable future economic benefits that have been obtained or are controlled by an entity as a result of past transactions or events. Thus, an asset is something that:

- arose from a **past** transaction,
- is **presently** owned by the company, and
- will provide a probable **future** economic benefit to the company.

Note that this definition encompasses three time periods: the past, the present and the future.

**Liabilities** are probable future sacrifices of economic benefits due to present obligations of an entity to transfer assets or provide services in the future, resulting from past transactions or events. Thus, a liability is something that:

- arose from a **past** transaction,
- is **presently** owed by the company, and
- will lead to a probable **future sacrifice** of economic benefits by the company.

The definition for liabilities contains the same three time periods as are contained in the definition of assets—the past, the present and the future.

**Equity** is net assets, or the residual (remaining) interest in the assets of an entity after deducting its liabilities from its assets. For a business entity, equity is the ownership interest.

### Current and Noncurrent Classification of Assets and Liabilities

On the balance sheet, assets and liabilities are classified as either **current** or **noncurrent**. Current assets and liabilities are short-term and noncurrent assets and liabilities are long-term, but the more correct terminology for both assets and liabilities is "current" and "noncurrent." Whether an asset or liability is classified as current or noncurrent depends upon the time frame in which the asset or liability is expected to be settled (for liabilities) or converted into cash (for assets).

**Note:** The **operating cycle** is the average time between the acquisition of resources (or inventory) and the final receipt of cash from the sale of those assets.

### Current Assets

Current assets are assets that will be converted into cash or sold or consumed within 12 months or within one operating cycle if the operating cycle is longer than 12 months. Therefore, an asset that will be converted into cash within 18 months may be classified as a current asset if the reporting company's operating cycle is 18 months long, but an asset that will be converted into cash within less than 12 months will **always** be classified as a current asset.

Current assets are perhaps the easiest of the various sections of the balance sheet to identify and include:

- Cash – Coins, currency, undeposited checks, money orders and drafts, and demand deposits.
- Cash equivalents – Short-term, highly liquid investments that are convertible to known amounts of cash without a significant loss in value and have maturities of 3 months or less from the date of purchase.
- Receivables – Trade accounts receivable, notes receivable, receivables from affiliates and officer and employee receivables.
- Inventories – Goods on hand and available for sale and, for a manufacturer, raw materials and work-in-process.

- Short-term investments maturing in less than one year – Marketable securities purchased with temporarily idle cash that can be sold to meet current cash needs or investments maturing within one year or the operating cycle, if longer. Marketable securities classified as trading securities are always current assets. Marketable securities classified as available-for-sale or held-to-maturity are current assets **if** the securities are considered working capital that is available for current operations. An available-for-sale or held-to-maturity security classified as a current asset could thus have a maturity of anything up to the length of the firm's operating cycle, if management considers it available for current operations. Alternatively, an available-for-sale or held-to-maturity security with a maturity of less than the length of the business's operating cycle might also be considered a **non**-current asset, if management does **not** consider it to be available for current operations.
- Prepaid expenses – Amounts paid in advance for the use of assets (such as rent) or for services to be received at a future date. Prepaid expenses are not convertible to cash, but they are classified as current assets because they would have required the use of current assets during the coming operating cycle if they had not been prepaid.

### Noncurrent Assets

Noncurrent assets are assets that will **not** be converted into cash within one year or during the operating cycle if the operating cycle is longer than one year. Noncurrent assets include:

- long-term investments,
- property, plant and equipment,
- intangible long-term assets, and
- other long-term assets such as long-term prepaid expenses, prepaid pension cost, and noncurrent receivables.

### Long-term Investments and Funds

Long-term investments and funds that management expects to hold for more than one year are included in noncurrent assets. Examples of these noncurrent assets are:

- Investments in nonconsolidated subsidiaries or affiliated companies made for the purpose of controlling or influencing the investee.
- Available-for-sale and held-to-maturity securities that are not current assets. Noncurrent securities can include stocks, bonds and long-term notes receivable. If management intends to hold them for more than one year, they are classified as long-term investments. Many securities classified as long-term investments are readily marketable, but the company does not include them in current assets unless it intends to convert them to cash with one year or within the operating cycle, whichever is longer.
- Funds that are restricted for noncurrent purposes, such as for the retirement of debt or to pay for the construction of fixed assets.
- The cash surrender value of a life insurance policy. The cash surrender value of a life insurance policy is essentially the amount that the holder of the policy would get from the insurance company if the policy were cancelled. Some firms own life insurance policies on the lives of their key employees, and such insurance policies are assets of the corporation.
- Fixed assets not currently being used in operations such as idle facilities or land held for future use.



### Property, Plant and Equipment (Fixed Assets)

Property, plant and equipment (PP&E) are tangible assets that are used in operations and will be used past the end of the current period. When the fixed assets are purchased they are recorded at their cost, including costs such as installation costs needed to bring the asset to usable condition. The cost is then expensed over the life of the asset through depreciation.

Examples of property, plant and equipment are:

- land, buildings, machinery, furniture, equipment, and vehicles,
- leasehold improvements, or improvements made to leased property at the lessee's expense,
- assets that have been obtained through a capital lease, and
- wasting resources such as timberland and minerals.

Except for land, a company either depreciates or depletes property, plant and equipment. Wasting resources are depleted, while other fixed assets (other than land) are depreciated. Land is neither depreciated nor depleted because land is not used up and does not wear out.

### Intangible Assets

Intangible assets are assets that do not have a physical substance but provide benefit to the firm over a period of time. Intangible assets may be either purchased or developed internally. However, because an asset comes about only as a result of a prior transaction, internally-generated intangible assets are not recorded on the balance sheet.

Examples of intangible assets are copyrights, patents, goodwill, trademarks and franchises. An intangible asset with a limited life is amortized over its useful life. An intangible asset with an indefinite life such as goodwill is assessed periodically for impairment.

Additional information about intangible assets is provided in the HOCK *Assumed Knowledge* e-Book.

### Other Noncurrent Assets

Other noncurrent assets include any noncurrent asset that is not included in any other category. Examples of other noncurrent assets are:

- noncurrent receivables,
- restricted cash or securities or assets in special funds,
- long-term prepayments, and
- deferred tax assets.

### Current Liabilities

Current liabilities are obligations that will be settled through the use of current assets or by the creation of other current liabilities.

Examples of current liabilities are:

- accounts payable due to suppliers for purchase of goods and services;
- trade notes payable arising from the purchase of goods and services;
- dividends payable;
- unearned revenues (advances and deposits received that represent obligations to supply goods and/or services);
- agency collections such as employee tax withholdings and sales taxes, where the company acts as agent for another party (the government) and is obligated to remit the payments;

- obligations that, according to their terms, are due on demand such as demand notes;
- short-term (30-, 60-, 90-day) notes;
- current portion of long-term debt (the portion of the principal due within the current period);
- taxes payable, wages payable and other accruals, and
- long-term obligations callable at the balance sheet date due to some violation by the company such as a violation of a loan covenant.<sup>5</sup>

Current liabilities **do not include** the following:

- debts to be paid by funds that are in accounts classified as noncurrent, and
- the portion of a short-term obligation that is intended to be refinanced by a long-term obligation. In order to classify such a current liability as a noncurrent liability, however, the company must have demonstrated the ability to refinance the obligation as a noncurrent liability. Having a commitment from a bank for long-term financing of the obligation is an example of a way to demonstrate the ability to refinance it.

### Noncurrent Liabilities

Noncurrent liabilities are liabilities that will **not** be settled within one year or the operating cycle if the operating cycle is longer than one year.

Examples of noncurrent liabilities are:

- Long-term notes or bonds payable.
- The long-term portion of long-term debt and liabilities for capital leases.
- Pension obligations.
- Long-term deferred tax liabilities.
- Obligations under warranty agreements.
- Advances for long-term commitments to provide goods and services.
- Long-term deferred revenue.

Most long-term debt is subject to various covenants and restrictions, requiring a great deal of disclosure in the financial statements.

Question 1: Long-term debt should be included in the current section of the statement of financial position if

- a) it is to be converted into common stock before maturity.
- b) it matures within the year and will be retired through the use of current assets.
- c) management plans to refinance it within the year.
- d) a bond retirement fund has been set up for use in its scheduled retirement during the next year.

(CMA Adapted)

<sup>5</sup> A covenant is a condition or a requirement in a loan agreement or in a bond indenture. (A bond indenture is the legal, binding contract between a bond issuer, the borrower, and the bondholders, the lenders.) Covenants may restrict the actions of the borrower or require that they meet certain requirements such as maintaining certain financial statement ratios. If the borrower fails to meet the requirements of the loan agreement, the loan becomes in default, just as if the borrower had failed to make scheduled loan payments, and the full principal and any accrued interest becomes immediately due and payable.

## Equity

**Equity** is the remaining balance of assets after the subtraction of all liabilities. Equity is the portion of the company's assets owned by and owed to the owners. If the company were to be liquidated, equity represents the amount that would theoretically be distributable to the owners.

All business enterprises have owners' equity, but the types of accounts in owners' equity will differ depending on the type of the entity. This discussion focuses on corporations, so the elements of owners' equity discussed here are the elements of a corporation's equity.

Owners' equity for corporations is split into six different categories.

- Capital stock, the par or stated value of the shares issued.
- Additional paid-in capital, or the excess of amounts contributed by owners from the sale of shares over and above the par or stated value of the shares issued.
- Retained earnings, or profits of the company that have not been distributed as dividends.
- Accumulated other comprehensive income items, or specific items that are not included in the income statement but are included in equity and do adjust the balance of equity, even though they do not flow to equity by means of the income statement as retained earnings do.
- Treasury stock, or the amount of shares repurchased (a contra-equity account that reduces equity on the balance sheet).
- Noncontrolling interest (minority interest), or a portion of the equity of subsidiaries that the reporting entity owns but does not own wholly.

**Note:** When a corporation repurchases shares of its own stock from the market, the repurchased shares are called **treasury shares** or **treasury stock**. Treasury shares purchased **reduce** owners' equity, because those shares are no longer outstanding.

## Use of the Balance Sheet

Because the balance sheet provides information on assets, liabilities and stockholders' equity, it provides a basis for computing rates of return, evaluating the capital structure of the business, and predicting a company's future cash flows.

The balance sheet helps users to assess the company's liquidity, financial flexibility, solvency and risk.<sup>6</sup> However, a statement of financial position can provide only a partial picture of either liquidity or financial flexibility unless it is used in conjunction with at least a statement of cash flows.<sup>7</sup> The statement of financial position can also be used in financial statement analysis to assess the company's ability to pay its debts when due and its ability to distribute cash to its investors to provide them an adequate rate of return.

**Liquidity** refers to the time expected to elapse until an asset is converted into cash or until a liability needs to be paid. The greater a company's liquidity is, the lower its risk of failure.

**Solvency** refers to the company's ability to pay its obligations when they are due. A company with a high level of long-term debt relative to its assets has lower solvency than a company with a lower level of long-term debt.

**Financial flexibility** is the ability of a business to take actions to alter the amounts and timing of its cash flows that enable the business to respond to unexpected needs and take advantage of opportunities.

**Risk** refers to the unpredictability of future events, transactions and circumstances that can affect the company's cash flows and financial results.

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<sup>6</sup> FASB Statement of Concepts No. 5, *Recognition and Measurement in Financial Statements of Business Enterprises*, paragraph 29.

<sup>7</sup> FASB Statement of Concepts No. 5, *Recognition and Measurement in Financial Statements of Business Enterprises*, paragraph 24.a.

### Limitations of the Balance Sheet

A balance sheet reports a company's financial position, but it does not report the company's value, for the following reasons:

- Many assets are not reported on the balance sheet, even though they do have value and will generate future cash flows. Examples of these assets include the company's employees, or its human resources, its processes and procedures, and its competitive advantages.
- Values of certain assets are measured at historical cost, not market value, replacement cost, or their value to the firm. For example, property, plant and equipment are reported on the balance sheet at their historical cost minus accumulated depreciation, although the assets' value in use may be significantly greater.
- Judgments and estimates are used in determining many of the items reported in the balance sheet. For example, estimates of the amount of receivables the company will collect are used to value the accounts receivable; the expected useful life of fixed assets is used to determine the amount of depreciation; and the company's liability for future warranty claims is estimated by projecting the number and the cost of the future claims.
- Most liabilities are valued at the present value of cash flows discounted at the rate that was current when the liability was incurred, not at the present value of cash flows discounted at the current market interest rate. If market interest rates increase, a liability that carries a fixed interest rate that is below market increases in its value to the company. If market rates decrease, a liability that is payable at a fixed rate that is higher than the market interest rate sustains a loss in value. Neither of these changes in values is recognized on the balance sheet.

Fair value is increasingly being used to measure items presented on the balance sheet. Furthermore, many items such as derivatives that previously were not reported on the balance sheet at all are now being reported at fair value.

Question 2: A statement of financial position provides a basis for all of the following **except**

- a) computing rates of return.
- b) evaluating capital structure.
- c) assessing liquidity and financial flexibility.
- d) determining profitability and assessing past performance for a specific period.

(ICMA 2010)

### The Income Statement

The income statement reports on the success of a company's operations during a given period of time. The income statement provides users with information to help them predict the amounts, timing, and uncertainty of (prospects for) future cash flows.

The income statement is created using the accrual method of accounting as applied to historical transactions. The income statement gives the results of operations for a **period of time** and is like a movie recording the events of the business for that period of time. This attribute of the income statement is in contrast to the balance sheet, which provides information as of **one moment in time**.

The accounts that are used to record revenues, expenses, gains and losses are **temporary accounts**. They are **closed to a permanent account** (retained earnings on the balance sheet) at the end of each period (fiscal year). Thus at the beginning of each fiscal year, the balances in the income statement accounts are zero.

Certain types of events are classified and reported separately on the income statement. The standard **multiple-step** income statement format includes the following sections:

	Sales or service revenues
-	<u>Cost of goods sold (COGS)</u>
=	<b>Gross profit</b>
-	<u>Selling, general, and administrative expenses</u>
=	<b>Operating income</b>
+	Interest and dividend income
-	Interest expense
+/-	<u>Non-operating gains/(losses)</u>
=	<b>Income from continuing operations before income tax</b>
-	<u>Provision for income taxes on continuing operations</u>
=	<b>Income from continuing operations</b>
+/-	Gains/(losses) on operations of discontinued component (net of applicable taxes)
+/-	<u>Gains/(losses) on disposal of discontinued component (net of applicable taxes)</u>
	Income before extraordinary item
+/-	Extraordinary gain/(loss)
	<u>Less: Applicable income tax</u>
=	<b>Net Income</b>

**Note:** "Income from continuing operations" on a multi-step income statement is **not** the same thing as "operating income."

Operating income includes revenues and expenses generated by the company's core business. Operating income does **not** include financial income (interest and dividend income) or financial expense (interest expense), nor does it include non-operating gains and losses or gains and losses on discontinued operations or extraordinary events.

Income from continuing operations, on the other hand, **does** include financial income and financial expense and non-operating gains and losses in addition to revenues and expenses generated by the company's core business.

Income from continuing operations refers to income (loss) **other than** gains (losses) from discontinued operations and extraordinary events. It is called income from **continuing** operations to distinguish it from gains and losses on discontinued operations and extraordinary events.

**The line "Income from continuing operations" appears on an income statement only if the firm is reporting results of discontinued operations.**

Similarly, the line "Income before extraordinary item" would appear on an income statement only if the firm is reporting extraordinary items.

A **single-step** income statement may also be used. A single-step income statement has only two groupings: revenues and expenses. Total expenses are subtracted from total revenues to determine the net income or loss. The single-step form of income statement is simpler and eliminates potential classification problems.

**Note:** In addition to all of this information regarding income, information regarding **Earnings per Share (EPS)** must also be disclosed on the face of the income statement.

## Elements of the Income Statement

**Revenues** represent inflows or other enhancements to assets or settlements of liabilities<sup>8</sup> as a result of delivering goods or providing services that are the entity's main or central operations. Revenues are usually recognized when the earnings process (the provision of goods or services to the customer) is complete and an exchange has taken place. The exchange does not need to include cash but may include a promise to pay in the future (a receivable).

**Note:** The **revenue recognition principle** requires revenues to be recognized in the accounting period in which the performance obligation is satisfied.

However, revenue may also be recognized under the following methods in the right circumstances:

- Percentage-of-completion for long-term contracts,
- Production basis for agricultural products and precious metals if they have (1) interchangeable (fungible) units and (2) quoted prices available in an active market that can rapidly absorb the quantity held by the entity without significantly affecting the price,<sup>9</sup>
- Installment basis, used when we are not certain of the collectability of the account, and
- Cost-recovery basis, a method of accounting for an installment basis sale where recognition of the gross profit is deferred until all cost of the sales has been recovered. Used when the seller is unable to measure the certainty of collectability.

**Expenses** are outflows or other using-up of assets or the incurrence of liabilities as a result of delivering goods or providing services that are the entity's **main or central operations**. Expenses are recognized based upon one of the following three methods:

- Cause and effect: the cost of a item sold is recognized as cost of goods sold when the item is sold,
- Systematic and rational allocation such as depreciation, and
- Immediate recognition: if an expense will not provide future benefit, it is immediately recognized.

**Note:** The **expense recognition principle**, commonly called the **matching principle**, states that recognition of expenses is related to net changes in assets and the earning of revenues. Expenses should be recognized during a period as a result of delivering or producing goods and/or performing services and recognizing the associated revenue during that period. Thus, expenses should be recognized when the work or product contributes to revenue. The expense recognition principle is implemented by matching efforts (or expenses) with accomplishments (revenues).

**Gains** are increases in equity as a result of transactions that are **not** part of the company's main or central operations and that do not result from revenues or investments by the owners of the entity.

**Losses** are decreases in equity as a result of transactions that are **not** part of the company's main or central operations and that do not result from expenses or distributions made to owners of the entity.

The difference between revenues and gains and between expenses and losses depends on what the company's typical activities are. For example, the sale of a product as part of a company's normal operations constitutes revenue. However, the sale of a fixed asset is not part of the company's regular operations, so the excess of the amount received for the asset over its net book value is a gain, not revenue.

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<sup>8</sup> Settlement of a liability creates revenue, for example, when the company has received a deposit from a customer for an order to be delivered in the future. The deposit is a current liability when received. When the order is fulfilled, the liability is debited to reduce it by the amount of the deposit, and the amount of the deposit is credited to revenue.

<sup>9</sup> Per FASB Statement of Concepts No. 5, paragraphs 84(e) and 83(a). Per paragraph 84(e): "If products or other assets are readily realizable because they are salable at reliably determinable prices without significant effort (for example, certain agricultural products, precious metals, and marketable securities), revenues and some gains or losses may be recognized at completion of production or when prices of the assets change. Paragraph 83(a) describes readily realizable (convertible) assets." Per Paragraph 83(a): "Readily convertible assets have (i) interchangeable (fungible) units and (ii) quoted prices available in an active market that can rapidly absorb the quantity held by the entity without significantly affecting the price."

## Other Income Statement Items

### Unusual Gains and Losses

Some items may need separate disclosure on the income statement in order to help users to predict amounts, timing and uncertainty of future cash flows. Some examples of unusual gains and losses are losses on write-downs of inventory or other assets or restructuring charges.

Companies generally report unusual items in a separate section on the income statement just above Income from Operations Before Income Taxes.

Unusual gains and losses are different from extraordinary gains and losses, covered below. Although unusual gains and losses do not qualify to be reported as extraordinary gains and losses, the firm may want to show them separately.

### Discontinued Operations

A discontinued operation is any component of an entity that has been or will be eliminated from the operations of the company and the company has no further significant involvement in that component after the disposal transaction.

A discontinued operation exists whenever a company makes a decision to dispose of an identifiable part of its business. The discontinuation can take the form of the sale of a part of the business or spinning-off part of the company to form a new company. The discontinuation can also occur through the abandonment of the assets.

All gains or losses that are incurred by the discontinued segment are **reported in the period in which the gain or loss occurred**; and this disclosure on the income statement is done net of taxes.

As soon as the company makes the decision to dispose of a component of the business, the operations (incomes and expenses) of the component to be disposed of should be reported on one line net of tax below income from continuing operations. When the actual disposal takes place, the gain or loss from the disposal is also reported net of tax below income from continuing operations. The gain or loss from the actual disposal of the component should be reported on a separate line from the gain or loss from the operations of the discontinued component, as follows:

Income from continuing operations

**Discontinued operations:**

**+/- Gain/(loss) on operations of discontinued component (net of applicable taxes)**

**+/- Gain/(loss) on disposal of discontinued component (net of applicable taxes)**

Net Income

In other words, all gains and losses from the component to be discontinued should be removed from income from continuing operations so users of the financial statements can see what income from continuing operations is without the operations of the component to be disposed of.

Companies use the line "**Income from continuing operations**" on the income statement only when gains or losses on discontinued operations occur.

### Extraordinary Items

The criteria for an item to be classified as extraordinary are:

- 1) **Unusual nature.** The event or transaction should be highly abnormal and be clearly unrelated to the ordinary and typical activities of the company.
- 2) **Infrequency of occurrence.** The event or transaction should be something the company does not reasonably expect to recur in the foreseeable future.

Classification of an event or transaction as extraordinary should occur only rarely, for example damage from a major casualty such as an earthquake **if** the company is not located in an area where earthquakes occur frequently.

When a company has a gain or loss from an extraordinary item, its income statement has a line "Income before extraordinary item" and the extraordinary gain or loss is reported below the line, net of applicable income tax, as follows:

Income before income tax and extraordinary item
Income Tax
Income before extraordinary item
<b>+ / – Extraordinary gain (loss) [describe]</b>
<b><u>Less: Applicable income tax</u></b>
<b>Net Income</b>

### Intraperiod Tax Allocation

Discontinued operations and extraordinary items need to be reported on the income statement net of their applicable taxes. That means taxes must be allocated among the various components of the income statement. This allocation of tax is called **intraperiod tax allocation** (allocation within one period). The income tax due should be allocated first to income from continuing operations. Then the remaining tax due should be pro-rated among gains/losses from discontinued operations, extraordinary items and any other items according to each one's proportion of the total other income.

### Noncontrolling Interest

A company may own less than 100% of the stock of another company, but it may own a large enough portion of the other company's stock that it has control over the other company and must consolidate the other company's financial results with its own financial results. In these cases, the other company is a subsidiary of the parent company but not a wholly-owned subsidiary. The **noncontrolling interest** in the other company is the portion of the equity in the subsidiary that is not owned by the parent.

Since the financial results of the parent and the subsidiary are consolidated, the net income of the consolidated entity includes some net income that does not belong to the parent because it belongs to the minority shareholder(s). When the parent prepares a consolidated income statement, the net income must be allocated between the controlling interest (the parent) and the noncontrolling interest (the minority shareholder[s]). The allocation is reported after net income on the income statement, as follows:

Consolidated net income
– <b><u>Less: Net income attributable to noncontrolling interest(s)</u></b>
<b>= Net income attributable to shareowners of the parent</b>

### Use of the Income Statement

The income statement helps users of the financial statements to predict future cash flows, as follows:

- It helps users to evaluate the company's past performance and to compare it to the performance of its competitors.
- It provides a basis for predicting future performance.
- It helps users to assess the risk or uncertainty of achieving future cash flows.



### Limitations of the Income Statement

Most of the limitations of the income statement are caused by its periodic nature. At any particular financial statement date, buying and selling will be in process, and some transactions will be incomplete. Therefore, net income for a period necessarily involves estimates, and these estimates affect the company's performance for the period.

Limitations that reduce the usefulness of the income statement for predicting amounts, timing and uncertainty of cash flows include:

- Net income is an estimate that reflects a number of assumptions.
- Income numbers are affected by the accounting methods used. For example, differences in methods of depreciation cause differences in amount of depreciation expense during each year of an asset's life. A lack of comparability between and among companies results from these differences in accounting methods.
- Income measurement involves judgment. For example, the amount of depreciation expense recorded during a period is dependent upon estimates regarding the useful lives of the assets being depreciated.
- Items that cannot be measured reliably are not reported in the income statement. For instance, increases in value due to brand recognition, customer service, and product quality are not reflected in net income.
- The income statement is limited to reporting events that produce reportable revenues and expenses. Generally, revenues and gains are not recognized until they can be reliably measured and are realizable. "Reliably measured" means they can be converted into a known amount of cash or claims to cash. "Realizable" generally means that the company has completed all of its obligations relating to the sale of the product, and the collection of the receivable is assured beyond reasonable doubt. Delaying the recognition of revenue until it is realizable is a means of dealing with the periodic nature of the income statement. However, some gains such as holding gains on available-for-sale securities are realizable but are not reported on the income statement. The available-for-sale securities could be sold immediately at the market price, but holding gains and losses on them are excluded from net income, though they are reported in accumulated other comprehensive income in the equity section of the balance sheet.

**Comprehensive income** is the total change in equity that results from all sources other than distributions to owners and investments by owners. It is a little closer to being an economic measure of income than net income is.

Question 3: The financial statement that provides a summary of the firm's operations for a period of time is the

- a) income statement.
- b) statement of financial position.
- c) statement of shareholders' equity.
- d) statement of retained earnings.

(ICMA 2010)

## The Statement of Cash Flows (SCF)

The SCF is one of the three main financial statements presented by companies (the other two are the balance sheet and income statement). The SCF must be presented by **all businesses** (profit and non-profit, public and private) whenever the company presents a balance sheet and income statement or just an income statement. Thus, if a company presents only income statements and no balance sheets for prior periods, it must also present the SCF for each of the prior periods.

The primary purpose of the SCF is to provide information regarding **receipts and uses of cash** for the company during a period of time.

The information on the SCF helps users of the financial statements to assess:

- the ability of the company to generate positive future cash flows and meet obligations as they come due;
- the reasons for differences between net income and net cash receipts and payments;
- the liquidity, solvency<sup>10</sup> and financial flexibility of the company;
- the effect of investing and financing transactions on the company's financial position; and
- the company's need for external financing.

### Classification Within the SCF

SCF presents all of the receipts and uses of cash of the company during the period. For the purposes of presentation and usefulness, the cash activities are broken down into **three main categories of activities** for the presentation in the SCF. These three categories are:

- Operating activities.
- Investing activities.
- Financing activities.

The sum of the cash flows from the three categories above equals the net increase or decrease in cash and cash equivalents during the period. The net increase or decrease in cash and cash equivalents is also reported in the SCF.

All transactions that involve cash will be classified in one of the three categories above. You will need to know what items are included in each of these three categories. Common exam questions on the SCF will be along the lines of "Which of the following items should be included in financing activities?"

The SCF also presents information about **noncash investing and financing activities**. Noncash investing and financing activities are investing or financing activities for which no cash is used. An example of a noncash financing activity is borrowing to purchase an asset when the lender sends the loan proceeds directly to the seller of the asset. The cash from the loan proceeds is never deposited to the buyer/borrower's bank account, and the payment for the asset never flows out of the account. An asset is purchased (investing) and a new obligation for a liability is incurred (financing), but there are no actual cash flows to be reported on the SCF. Information on noncash investing and financing activities is presented in the **disclosures** (notes) to the statement of cash flows.

The main items that go into each of the three categories are listed below.

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<sup>10</sup> "Solvency" refers to the ability of a company to meet its long-term financial obligations. If a company is to remain in business, it must remain solvent.

### Cash Flows from Operating Activities

In general, any item that is not classified as either an investing or financing activity is an operating activity. To be more specific, cash flows from operating activities are cash inflows and cash outflows that result from the company's main business activities and central operations.

Transactions that cause gains or losses are generally **not** considered operating activities. The only exception to the preceding statement is cash flows from purchases, sales and maturities of trading securities being held for sale in the near term. Cash flows from the purchase, sale and maturity of trading securities usually **are** classified as operating activities, but whether to classify them as operating or investing activities is a management decision. Some securities that are classified as trading securities are not being held for sale in the near term, and so their purchase, sale or maturity would be an investing, not an operating, cash flow. Therefore, cash receipts and cash payments related to trading securities reported at fair value should be classified **based on the nature and purpose for which the securities were acquired**. The facts and circumstances of each individual investment in trading securities need to be evaluated to determine whether their cash flows are to be classified as operating activities or as investing activities.

The following specific items are classified as operating activities:

- Cash received from customers and paid to suppliers in the course of the company's primary business activity.
- Interest paid on bonds and other debt (loans, leases, and mortgages).
- Interest received and dividends received from debt and equity investments.
- Cash paid to the government for taxes and cash received back from the government as tax refunds, except as noted below under *Cash Flows from Financing Activities*.
- Cash flows from the purchase, sale and maturity of trading securities **usually** will be classified as operating activities, not investing activities. However, as noted above, some securities are classified on the balance sheet as trading securities even though they are not being held for sale in the near term. Cash receipts and cash payments related to trading securities reported at fair value should be classified on the SCF based on the nature and purpose of the securities. Therefore, the facts and circumstances of the situation need to be evaluated to determine whether cash flows from trading securities are to be classified as operating activities or as investing activities.

### Cash Flows from Investing Activities

Investing activities are those activities that the company undertakes to generate a future profit, or return, from investments. Events that are investing activities are:

- Purchasing and selling property, plant and equipment (fixed assets).
- Making and collecting loans to other parties.
- Acquiring and disposing of available-for-sale or held-to-maturity securities (equities and debt instruments).
- In addition, as mentioned above, cash flows from the purchase, sale and maturity of trading securities may be classified as investing activities if the securities are not being held for sale in the near term.

### Cash Flows from Financing Activities

Financing activities are the activities that a company undertakes to raise capital to finance the business. Events that are considered to be financing activities include:

- Issuance of stock.
- Treasury stock transactions.

- Paying dividends (note that dividends **paid** are financing activities, but dividends **received** are operating activities).
- Issuing debt (bonds).
- Obtaining a loan and repaying the principal of the loan.
- Repayment of principal on other debt obligations, including repayment of the principal portion of capital lease payments for fixed assets. (The interest portion of payments on capital leases and loans is classified as cash flows from operating activities.)
- Normally, cash flows from taxes paid and tax refunds received are classified as operating activities. However, certain cash flows relating to income tax expense associated with share-based compensation are classified as financing activities.

**Note:** We recommend that you know the specific items listed under each of the three categories.

### Use of the Statement of Cash Flows

The statement of cash flows is very important for determining a company's financial health. Though net income provides a measure of a company's success or failure, cash is what the company needs in order to survive.

A company can report high and growing net income but may have negative cash flow from operations. For example, if the profits the company is earning are tied up in growing receivables and inventory, it may not have enough cash to pay its ongoing expenses. Increasing receivables can result from sales growth (a good thing), but increasing receivables can also result from customers who do not pay their bills (a bad thing). Increasing inventory can also result from sales growth (a good thing), but increasing inventory can also result from slow-moving inventory that has become obsolete (a bad thing). A user of the statement needs to be able to determine the causes of the increased receivables or inventory.

Low or negative cash flow from operations can also indicate that the company's sales and/or profits are not adequate and the company is in serious financial trouble.

Lenders and other creditors use the cash flow statement, particularly the cash flow from operations section, to determine whether they will get paid. A high amount of operating cash flow indicates a company is generating enough cash from its operations to cover its debt obligations. A low or negative operating cash flow indicates the company may have to borrow to pay its ongoing operating costs.

If the company pays a dividend, investors look at the statement of cash flows to determine whether the dividend is sustainable. If the dividend being paid is greater than the company's cash flow from operations, a dividend cut is probably in the future.

In a company that is growing, borrowing to pay current cash needs is understandable because of the increased working capital needs that sales growth brings. However, beyond a point, borrowing to pay current obligations is not sustainable because there is a limit to how much a company can borrow. Furthermore, as long as the sales growth continues, the company will not be in a position to repay the debt. Growth can be better financed through increased equity. A company with high sales growth and a great need of cash to support its increased working capital needs can even go bankrupt if it is not able to appropriately finance its working capital needs to support its sales growth.

The statement of cash flows reveals to lenders and potential investors how the company is using its cash. For example, a negative operating cash flow and a positive financing cash flow indicates that the company is financing its operations with either debt or equity. An examination of the financing section of the statement will reveal whether debt or equity is being used. The user of the statement needs to be able to interpret the meaning of what he or she is seeing in the statement of cash flows, in order to determine whether the company is going through "growing pains" that can be handled through appropriate financing and if so, whether the company's financing is appropriate, or whether the company is developing serious financial difficulty that could lead to bankruptcy.

### Limitations of the Statement of Cash Flows

The statement of cash flows shows only how much cash was received and paid out for operating, investing and financing activities. The statement of cash flows alone would not show that, for example, a positive operating cash flow was achieved by not paying the payables when due. The existence of past due payables is important information for a user to have in interpreting the statement of cash flows and for analyzing the financial condition of the company. In order to recognize something like past due payables, the balance sheet and income statement are needed. For that reason, the statement of cash flows needs to be interpreted in the context of the other financial statements.

The indirect method of preparing the SCF has an additional limitation. It does not show the sources and uses of operating cash individually but shows only adjustments to accrual-basis net income. Because of this limitation, a user can have difficulty in comprehending the information presented.

For that reason, the direct method is preferable even though both methods are acceptable. The indirect method is more commonly used, however, because a separate reconciliation between the income statement and cash flows from operating activities is not required, as it is with the direct method. Under the indirect method, the reconciliation is created when the cash flows from operating activities figure on the statement of cash flows is calculated because it begins with net income.

Question 4: Dividends paid to company shareholders would be shown on the statement of cash flows as

- a) Operating cash inflows.
- b) Operating cash outflows.
- c) Cash flows from investing activities.
- d) Cash flows from financing activities.

(CMA Adapted)

### Overview of the Preparation of the Statement of Cash Flows

One of the good things about the SCF is that we know the net cash flow from all three sources combined before we begin to prepare the statement. The total of the cash flows from operating, investing and financing activities must be equal to the amount of change in the balance of cash and cash equivalents from the beginning of the year to the end of the year. Because the cash and cash equivalents balances for the prior period and the current period are on the balance sheet, we can easily see what the total increase or decrease in cash was for the period. The main task with the SCF is determining how to classify the individual cash flows and to reconcile their total cash flows with the amount of change in cash and cash equivalents during the period.

Cash flows from operating activities may be calculated in two different ways, and both ways are acceptable. The two acceptable methods are called the **direct method** and the **indirect method**. Both are acceptable under U.S. GAAP, and a company can choose the method it uses. However, to be consistent, the company must use the same method from one period to the next.

You will need to be familiar with both the direct and the indirect method, be able to calculate any of the individual numbers that would be included in the SCF, be able to prepare an entire SCF, and be able to reconcile the statement of cash flows to the income statement and the balance sheets using the indirect method.

The direct and the indirect method **differ only in the presentation of the operating activities section**. The investing and financing activity sections are prepared in the same manner and look exactly the same under both methods of preparation.

Sources of information to compile the cash flow statement:

- Comparative balance sheets, used to calculate the amount of change in assets, liabilities and equity items from the beginning of the period to the end of the period. Usually this will be two years of balance sheets.
- Current income statement.
- Selected transaction data from the general ledger as needed for additional detailed information to determine how cash was provided or used during the period.

**Note:** The direct and indirect methods are different **only in their presentation of cash flows from operating activities**. Despite the difference in presentation, the end total of net cash flows from operating activities will be exactly the same under both methods. The difference between the two methods relates only to the presentation of the information, not to the results.

### Overview of the Two Methods

The **direct method** shows each item that affected cash flow, such as cash collected from customers. Each item is calculated by starting with the relevant item on the income statement (for example, sales revenue for cash collected from customers) and adjusting it using the balances in the relevant balance sheet account(s) at the beginning of the period and at the end of the period covered by the income statement (for example, accounts receivable for cash collected from customers).

Each individual line on the income statement is also adjusted to remove the effect of noncash transactions (such as depreciation expense) and non-operating activity transactions (such as gains or losses on the sale of fixed assets). After these adjustments are made, we will have what is in fact a cash basis income statement of operating activities.

Under the **indirect method**, all adjustments are made to the net income figure from the income statement. The adjustments that are made will be the same as they are for the direct method: adjustments for changes in balance sheet accounts and the elimination of noncash and non-operating activity transactions.

Both of these methods produce the same result for net cash flow from operating activities, because the same adjustments are made to the amounts on the income statement. The difference is that under the direct method, **each individual line** on the income statement is adjusted, whereas under the indirect method, the **net income figure** is adjusted.

The FASB prefers the **direct** method to the **indirect** method. If the direct method is used, the FASB requires a reconciliation of net income to net cash flow from operating activities to be provided in a separate schedule. That reconciliation reports the same information as would be reported by the cash flows from operating activities section prepared using the indirect method. Therefore, a company that chooses to prepare the cash flow from operating activities section of its SCF using the direct method will effectively need to prepare its SCF according to both the direct and the indirect methods. **The indirect method is used more extensively in practice.**

Question 5: The presentation of the major classes of operating cash receipts (such as receipts from customers) less the major classes of operating cash disbursements (such as cash paid for merchandise) is **best** described as the

- a) Direct method of calculating net cash provided or used by operating activities.
- b) Cash method of determining income in conformity with generally accepted accounting principles.
- c) Format of the statement of cash flows.
- d) Indirect method of calculating net cash provided or used by operating activities.

(ICMA 2010)

Question 6: The most commonly used method for calculating and reporting a company's net cash flow from operating activities on its statement of cash flows is the

- a) Direct method.
- b) Indirect method.
- c) Single-step method.
- d) Multiple-step method.

(ICMA 2010)

### Format of the Statement of Cash Flows

You may be required to prepare a complete SCF on the exam, and the format below is provided to help you put a statement together should you be required to do so.

The correct format for the SCF is as follows (the bolded items are only for emphasis):

<b>Name of Company</b> <b>Statement of Cash Flows</b> <b>For the Year Ended XXXX XX, 20XX</b>		
<b>Cash flows from operating activities</b>		
.....	\$X	
.....	X	
.....	<u>X</u>	
Net cash flows from operating activities		\$X
<b>Cash flows from investing activities</b>		
.....	\$X	
.....	X	
.....	<u>X</u>	
Net cash flows from investing activities		\$X
<b>Cash flows from financing activities</b>		
.....	\$X	
.....	X	
.....	<u>X</u>	
Net cash flows from financing activities		<u>\$X</u>
Net increase in cash and cash equivalents		\$X
Cash and cash equivalents at beginning of year		<u>\$X</u>
Cash and cash equivalents at end of year		<u>\$X</u>

Supplemental schedule of **noncash investing and financing** activities:

- XXXXX
- XXXXX

Please note the order of the three sections and the order in which we show the beginning and the ending cash balances for the year. This is the correct way to do this and how you should present it if required.

**Note:** The above format can be used for either the direct or indirect methods. Under these two different methods the **only difference will be in the presentation of the cash flows from operating activities.**

Question 7: A statement of cash flows prepared using the indirect method would have cash activities listed in which one of the following orders?

- a) Financing, investing, operating.
- b) Investing, financing, operating.
- c) Operating, financing, investing.
- d) Operating, investing, financing.

(ICMA 2010)

### Additional Statement of Cash Flows Disclosures

When the SCF is prepared using the direct method, a disclosure of the reconciliation between net income and cash flows from operating activities is required.

When the SCF is prepared under the indirect method, a disclosure of the amount of cash paid for interest and cash paid for taxes is required.

Noncash investing or financing transactions—transactions that are either investing or financing in nature but did not involve cash in the transaction—must be presented separately in a schedule at the end of the statement of cash flows.

### Preparation of a Statement of Cash Flows Using the Indirect Method

This exam requires candidates to be able to prepare a statement of cash flows using the indirect method for cash flows from operating activities.

#### Cash Flows from Operating Activities Under the Indirect Method

Under the indirect method of preparing the cash flows from operating activities section of the SCF, we start with **net income** as the top line of the operating activities section of the SCF and then make adjustments to net income by reversing noncash and non-operating items included in net income.

**Note:** When the indirect method is used, the amount of **cash paid** for interest and the amount of **cash paid** for taxes must be disclosed at the end of the statement in a supplementary schedule.

Net income is adjusted for four types of items, as follows.

- Eliminate noncash income and expense items such as depreciation that are included in the income statement.
- Eliminate investing and financing activity events whose results are included in the income statement, for example gains and losses on the income statement.
- Include the effect of any operating activities that were **not** included in net income but **did** have a cash effect and exclude (eliminate) the effect of any events that **are** included in net income but **did not** have a cash effect. Examples of these adjustments are those that must be made for changes in receivables, payables, inventory and other assets and liabilities.
- Cash flows from the purchase, sale and maturity of trading securities will usually be classified as operating activities, not investing activities (explained above). If those cash flows are to be classified as operating activities on the SCF, those cash flows will need to be included as an adjustment to reconcile net income to net cash from operating activities.



We will look at these adjustments in more detail below.

### 1) Eliminate Noncash Income Statement Items

Perhaps the most obvious example of the required adjustments, and one of the easiest, is the elimination of **depreciation and amortization expense**. Net income will have been reduced by depreciation and amortization expense, but the company did not have to pay out any cash related to these expenses. Therefore, the amount of depreciation and/or amortization expense that was charged against net income will need to be **added back** to net income in order to determine the net cash from operating activities (the cash basis income).

Note that the depreciation to be added back to net income is only the depreciation that was **expensed**. Manufacturing depreciation may be partially expensed in cost of goods sold (attached to units that were sold during the year) and partially capitalized in inventory (attached to units that were unsold at year end). Depreciation that was expensed will include (1) manufacturing depreciation expense in cost of goods sold<sup>11</sup> and (2) sales and administrative depreciation expense. Any depreciation that was capitalized in inventory for units that were unsold at the end of the period will be an adjustment to ending inventory when the amount of change in inventory is calculated (discussed below). The total amount of depreciation capitalized in inventory and the depreciation amounts expensed in cost of goods sold and in sales and administrative expense need to be disclosed in the Notes to the Financial Statements.

Any other noncash items also need to be eliminated. Another type of non-cash adjustment to net income that needs to be reversed is **unrealized** gains or losses on trading securities. Unrealized gains and losses on trading securities arise because of changes in the market value of trading securities, and they are charged to net income in the period in which they occur. However, they do not represent any cash activity and therefore they need to be reversed.

### 2) Eliminate Investing and Financing Activity Events Included in the Income Statement

The income statement reports the results of all transactions that the company entered into during the period. However, some of those events are not operating activities. In calculating cash flows from operating activities using the indirect method, we need to eliminate all the items in the income statement that do not relate to operating activities. The events that need to be eliminated as non-operating activities are identified on the income statement as realized gains and losses.

The most common realized gains and losses on the income statement that are eliminated in determining cash flow from operating activities are:

- Realized gains or losses from the sale of equipment or other fixed assets,
- Realized gains or losses on the sale of securities classified on the SCF as operating activities,<sup>12</sup> and
- Realized gains or losses on the sale of securities classified on the SCF as investing activities.<sup>13</sup>

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<sup>11</sup> When absorption costing is used in manufacturing, depreciation recorded on production assets is a fixed cost that is added to the cost of goods manufactured and is capitalized in inventory until the goods are sold. Thus, the cost of each unit produced includes some amount of depreciation. As each unit is sold, the depreciation attached to it moves to cost of goods sold on the income statement along with the other costs attached to the unit. Thus, a certain amount of depreciation recorded during production is included in inventory at each financial statement date and a certain amount is included in cost of goods sold.

<sup>12</sup> Realized gains and losses on trading or other securities classified as operating activities on the SCF are removed because the full amount of the cash received will be used to adjust net income in the calculation of net cash flows from operating activities. The amount of the gain or the loss will be embedded in the amount of the cash received, so to report it twice would be double counting it.

<sup>13</sup> Unrealized gains and losses on available-for-sale securities are presented in accumulated other comprehensive income, a component of equity, and are not on the income statement. Unrealized gains and losses on held-to-maturity securities are not recognized on either the income statement or the balance sheet. Thus, the only gains and losses on the income statement for either available-for-sale or held-to-maturity securities will be realized gains and losses on securities that have been sold or otherwise disposed of. See the HOCK *Assumed Knowledge* e-book if you need further explanation of accounting for investments.

By definition, gains and losses arise from secondary business activities and are therefore not operating activities. They will most likely be included in cash flows from investing activities but could also arise from some financing activities. Any gains or losses on trading securities classified as operating activities will be included in the total cash received from the sale of the securities and in the total cash used in purchasing the securities, which are separate adjustments.

These gains and losses on the income statement need to be eliminated in full in the preparation of the cash flows from operating activities portion of the statement of cash flows when the indirect method is used. To eliminate gains and losses,

- gains are subtracted from net income, and
- losses are added back to net income.

Remember that each event that gave rise to a gain or loss will need to be included in the SCF in either the investing or financing activities section (or the operating activities section if for trading securities classified as operating activities).

### 3) Individual Account Adjustments

After taking out the noncash items and investing and financing activity items, the company next needs to make adjustments for changes in individual asset and liability accounts that are related to operating activities.

The adjustments for a few of the individual accounts are discussed in detail, and then a general rule that can be used in this process is presented.

#### Net Accounts Receivable

An adjustment needs to be made to net income for the change in the net accounts receivable<sup>14</sup> balance over the period.

If the ending net accounts receivable balance is higher at the end of the year than it was at the beginning, it means that more people bought something and have not yet paid for it than people who bought something last year and paid for it this year. Therefore, if net accounts receivable increases during the period, it means that cash collections were actually lower than the revenue recognized. This amount of the **increase in net accounts receivable** will need to be **subtracted from net income** because the cash corresponding to the revenue has not yet been received.

On the other hand, if the net accounts receivable balance decreases during the year, it means that the company collected more cash from last year's sales (for example, sales made in December of last year) than it failed to collect from this year's sales (for example, sales made this December). This **decrease in net accounts receivable** over the period will therefore need to be **added to net income** in order to properly calculate the cash received from operating activities.

Make sure to use the amount of change in **net** accounts receivable, not the amount of change in gross accounts receivable.

**Note:** Any other receivable account that affected net income will need a similar adjustment made for it.

#### Accounts Payable

As with accounts receivable, an adjustment will also need to be made to reflect the change in the accounts payable balance during the period.

Accounts payable are related to the cost of goods sold line on the income statement because cost of goods sold on the income statement is calculated using, among other things, the amount of inventory that was

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<sup>14</sup> Net accounts receivable is gross accounts receivable less the balance in the allowance for doubtful debts account, since the allowance for doubtful debts account is a valuation account that decreases the balance in accounts receivable to a level the company thinks is collectible.

purchased during the year. If the company purchased inventory but did not pay for it during the year, its accounts payable will go up during the year. The company has recognized an expense, but has not yet paid for it. Therefore, any **increase in accounts payable must be added back to net income** because net income has been decreased by the expense but the cash has not yet been paid.

Similarly, a decrease in accounts payable means that the company paid for items that it did not purchase this year. In order to create the equivalent of a cash basis net income, this **decrease in accounts payable will need to be subtracted from net income**.

**Note:** Any other payable or other liability account that affected net income will need a similar adjustment made for it.

### Inventory

An increase in inventory during the period indicates the company has paid cash for inventory items that have not yet been expensed as cost of goods sold. Therefore, the amount of increase in the inventory account needs to be subtracted from net income.

Similarly, a decrease in the inventory account needs to be added to net income.

If information on the amount of manufacturing depreciation included in ending inventory is given in the Notes to the Financial Statement, use it to **decrease** the ending inventory balance before calculating the amount of change in inventory to adjust net income. Beginning inventory should **not be decreased**, however, because the amount of depreciation included in beginning inventory resulted from noncash transactions recorded during the period **previous** to the one on which we are reporting. We back out only the noncash depreciation that is in ending inventory because only the depreciation in ending inventory was recorded during the period on which we are reporting.

### Rules for Increases and Decreases in Asset and Liability Accounts

Below is a set of rules for the way net income is adjusted for changes in various assets and liabilities. These rules can be used for any operating activity asset or liability account when using the indirect method for calculating net cash flows from operating activities.

The following rules apply for adjusting net income:

#### Assets:

- The amount of an **increase** in an asset should be **deducted** from net income.
- The amount of a **decrease** in an asset should be **added** to net income.

#### Liabilities:

- The amount of an **increase** in a liability should be **added** to net income.
- The amount of a **decrease** in a liability should be **deducted** from net income.

**Note:** The rule is that assets adjust net income to cash flow in the opposite way that the account balance changes, whereas liabilities adjust net income to cash flow in the same direction as the account balance changes.

### Additional Indirect Method Considerations

Other items that you need to pay particular attention to are the **bond discount or premium account** and the **deferred tax asset or liability account(s)**. Changes in these accounts require adjustments to the net income figure just like other assets and liabilities do.

However, remember that bond discounts are **decreases** in the valuation of the bond on the balance sheet, whether they are contra-assets (to a bond carried as an investment asset) or contra-liabilities (to a bond

issued by the company as debt and carried as a liability). They are thus carried as negative balances. Regular amortization of the discount **increases** the valuation of the related asset or liability. Even though discount amortization causes the balance in the contra account to decrease toward zero on an absolute basis, the amortization results in an **increase** to the net carrying value of the asset or liability.

Bond premiums work the opposite way. They **increase** the valuation of the bond on the balance sheet. As the premium is amortized, the amount in the valuation account decreases toward zero and the amortization results in a **decrease** to the net carrying value of the asset or liability.

Changes to deferred tax assets and deferred tax liabilities represent amounts that have been recorded in net income but have not affected cash. Those change amounts should be added to or deducted from net income in accordance with the basic asset and liability rules given above.

#### 4) Cash Flows from the Purchase, Maturity and Sale of Trading Securities

Cash flows from the purchase, sale and maturity of trading securities are to be classified based on the **nature and purpose for which the securities were acquired**. Usually, this means they will be classified as operating activities, not investing activities. This classification as operating activities is not an absolute requirement, but if management considers it appropriate to classify them as operating activities, this will be another adjustment to reconcile net income to net cash from operating activities.

The amount of the cash outflow for a purchase is the amount of cash used for the purchase. The amount of the cash inflow for a sale or maturity is the full amount of the cash received.

#### 5) Disclosures

When the indirect method is used to prepare the SCF, the amount of **cash paid for taxes** and the amount of **cash paid for interest** must be disclosed because the cash paid for income taxes and for interest will be included in the Net Cash Flows from Operating Activities line on the SCF, and users need to know their individual amounts. This disclosure will be done at the end of the SCF as a supplemental schedule.

#### Summary – Cash Flows from Operating Activities Under the Indirect Method

Below is a summary of the steps followed in preparing the operating activities section under the indirect method. They are presented here to help you see how all of the items discussed above fit together.

- **Add all depreciation and amortization expense** back to net income.
- **Add all non-operating losses** on the income statement back to net income.
- **Subtract all non-operating gains** on the income statement from net income.
- **Add and subtract the changes in balance sheet accounts that are related to operating activities** – net accounts receivable, accounts payable, inventory, other payables and receivables, bond discount or premium, and other assets and liabilities. All of these items are adjustments to net income in accordance with the rules set out in the *Rules for Increases and Decreases in Asset and Liability Accounts* above.
- If purchases, sales and maturities of trading securities are being classified as operating activities, subtract cash used to purchase trading securities and add cash received for trading securities that were sold or that matured.
- In addition to the above adjustments, the cash amounts for **income taxes paid** and **interest paid** need to be disclosed in a **supplemental schedule**.

**Exam Tip:** If an exam problem requires the use of the indirect method and does not give the amount of net income for the period, net income can usually be calculated by analyzing the amount of change in retained earnings from one year to the next. Retained earnings are increased by net income and reduced by any dividends declared during the period. Therefore, if you know the beginning and ending retained earnings balances and the amount of dividends declared, if any, you can calculate the amount of net income for the period.

Question 8: For the fiscal year just ended, Doran Electronics had the following results.

Net income	\$920,000
Depreciation expense	110,000
Increase in accounts payable	45,000
Increase in accounts receivable	73,000
Increase in deferred income tax liability	16,000

Doran's net cash flow from operating activities is

- a) \$928,000
- b) \$986,000
- c) \$1,018,000
- d) \$1,074,000

(ICMA 2010)

### Cash Flows from Investing Activities

To determine the cash inflows and/or outflows from investing activities, we must look at all cash flows relating to the items included in investing activities. Inflows must be reported separately from outflows for the same type of transaction. For example, purchases of fixed assets must be reported on a separate line from sales of fixed assets. They are not to be netted together.

In an exam question on the statement of cash flows, frequently some of the information needed to answer the question will be in the section of "Other Additional Information" given in the question.

When calculating the cash inflows or cash outflows from investing activities, it is important to remember that we are interested only in the **amount of cash involved in the transaction**. Information regarding the gain or loss on the transaction or the book value of the item bought or sold is not the amount that we are interested in. Although sometimes we need to use information on book value and gain or loss on the sale to **calculate** the amount of cash paid or received, neither the book value nor the gain or loss are used and should not appear in the statement of cash flows.

**Example:** Knox Co. sold a fixed asset that had an original cost of \$20,000 and accumulated depreciation of \$12,000 at the time of the sale. Knox realized a gain of \$5,000 on the sale.

Although the amount of cash received on the sale is not provided, it can be calculated from the information that is provided, as follows.

At the time of the sale the asset had a book value of \$8,000 (\$20,000 cost – \$12,000 accumulated depreciation). Since the asset was sold at a \$5,000 gain, we know that Knox must have received \$5,000 more than the book value, or \$13,000. This \$13,000 is the amount that is presented on the statement of cash flows in investing activities as cash received from the sale of equipment.

In addition, the \$5,000 gain will be an adjustment in the operating section of the statement of cash flows prepared using the indirect method. The gain will be a deduction from net income because it will be included in the cash received from investing activities.

The main issue in calculating cash flows from investing activities will be the sale of property, plant or equipment. Remember that the amount reported in the investing activities section of the statement of cash flows is **the amount of cash** that was received or paid. The question may not give this amount directly but will require you to calculate it using the book value and gain or loss on the sale.

Remember that the amount of any gain or loss on the sale of fixed assets included in net income needs to be adjusted out of net income when calculating net cash flow from operating activities using the indirect method, as well.

**Note:** In reporting investing and financing activities, **do not net together cash paid and cash received** amounts, even when they are for the same classification of items. For example, the statement of cash flows should have separate lines for "Cash paid to purchase equipment" and "Cash received from the sale of equipment."

Question 9: Three years ago, James Company purchased stock in Zebra Inc. at a cost of \$100,000. This stock was sold for \$150,000 during the current fiscal year. The result of this transaction should be shown in the Investing Activities Section of James' statement of cash flows as

- a) Zero
- b) \$50,000
- c) \$100,000
- d) \$150,000

(ICMA 2010)

### Cash Flows from Financing Activities

The determination of cash flows from financing activities is done in the same manner as that for investing activities. Again, we are **interested only in the amount of cash in the transaction**. For example, we include on the SCF only the amount of cash paid to redeem an outstanding bond issue before its maturity date (including any premium required to be paid due to the early redemption), not the book value of the bond on the date of the redemption or the gain or loss on the early extinguishment of the debt. However, as was the case with investing activities, we may need the information on the book value and the gain or loss in order to calculate the amount of cash actually paid to redeem the bond, if that information is not given.

Furthermore, the amount of any gain or loss on early extinguishment of debt included in net income needs to be adjusted out of net income when calculating net cash flow from operating activities.

### Noncash Investing and Financing Activities

Some investing and financing activities are not included on the face of the statement of cash flows (meaning within the statement itself) because they are **noncash** investing or financing transactions. As the name implies, noncash transactions are transactions that are either investing or financing in nature but did not involve cash in the transaction.

Examples of noncash investing and financing transactions are:

- Debt converted to equity.
- Borrowing money to purchase a fixed asset when the lender pays the loan proceeds directly to the seller of the asset to make sure the loan proceeds are used as intended.
- Buying or selling fixed assets for something other than cash (for example, stock).
- Obtaining a building or other item by gift.
- Exchanging noncash assets or liabilities for other noncash assets or liabilities.

Despite the fact that no cash is involved in these transactions, they need to be disclosed in the statement of cash flows. Noncash investing or financing activities must be presented **separately in a schedule at the end of the statement of cash flows**. This disclosure is required because these events may be very important for a potential investor to know about. For example, if the company makes a practice of issuing new shares to acquire fixed assets, the disclosure of that fact will let the potential investor know that his or her ownership share will be diluted as the company buys fixed assets.

Question 10: Helicon accrued a gain from the sale of equipment for cash. The gain should be reported in the statement of cash flows using the indirect method in:

- a) Investment activities as a reduction of the cash inflow from the sale.
- b) Investment activities as a cash outflow.
- c) Operating activities as a deduction from income.
- d) Operating activities as an addition to income.

(Source Unknown)

Question 11: The following information was taken from the accounting records of Johnson Corporation for the year ended December 31:

Proceeds from issuance of preferred stock	\$8,000,000
Dividends paid on preferred stock	800,000
Bonds payable converted to common stock	4,000,000
Payment for purchase of machinery	1,000,000
Proceeds from sale of plant building	2,400,000
2% stock dividend on common stock	600,000
Gain on sale of plant building	400,000

The net cash flows from investing and financing activities that should be presented on Johnson's statement of cash flows for the year ended December 31 are, respectively:

- a) \$1,400,000 and \$7,200,000
- b) \$1,400,000 and \$7,800,000
- c) \$1,800,000 and \$7,800,000
- d) \$1,800,000 and \$7,200,000

(Source Unknown)

Question 12: Chelny Co. uses the indirect method in its statement of cash flows. The amortization of a patent should be presented as a(n):

- a) Cash flow from investing activity.
- b) Cash flow from financing activity.
- c) Deduction from net income.
- d) Addition to net income.

(HOCK)

Question 13: Selected financial information for Kristina Company for the year just ended is shown below.

Net income	\$2,000,000
Increase in accounts receivable	300,000
Decrease in inventory	100,000
Increase in accounts payable	200,000
Depreciation expense	400,000
Gain on the sale of available-for-sale securities	700,000
Cash receivable from the issue of common stock	800,000
Cash paid for dividends	80,000
Cash paid for the acquisition of land	1,500,000
Cash received from the sale of available-for-sale securities	2,800,000

Assuming the indirect method is used, Kristina's cash flow from operating activities for the year is

- a) \$1,700,000
- b) \$2,000,000
- c) \$2,400,000
- d) \$3,100,000

(ICMA 2010)

Question 14: Bertram Company had a balance of \$100,000 in retained earnings at the beginning of the year and \$125,000 at the end of the year. Net income for this time period was \$40,000. Bertram's statement of financial position indicated that dividends payable had decreased by \$5,000 throughout the year, despite the fact that both cash dividends and a stock dividend were declared. The amount of the stock dividend was \$8,000. When preparing its statement of cash flows for the year, Bertram should show cash paid for dividends as

- a) \$20,000
- b) \$15,000
- c) \$12,000
- d) \$5,000

(ICMA 2010)

Question 15: Kelli Company acquired land by assuming a mortgage for the full acquisition cost. This transaction should be disclosed on Kelli's Statement of Cash Flows as a(n)

- a) Financing activity.
- b) Investing activity.
- c) Operating activity.
- d) Noncash financing and investing activity.

(ICMA 2010)



Question 16: The net income for Hudson Co. was \$3 million for the year ended December 31. Additional information is as follows:

Depreciation on fixed assets	\$1,500,000
Gain from the cash sale of land	200,000
Increase in accounts payable	300,000
Dividends paid on preferred stock	400,000

The net cash provided by operating activities in the statement of cash flows for the year ended December 31 should be:

- a) \$4,200,000
- b) \$4,500,000
- c) \$4,600,000
- d) \$4,800,000

(Source Unknown)

### Cash Equivalents on the Statement of Cash Flows

A **cash equivalent** is defined as a highly liquid, short-term investment that is easily converted into a known amount of cash without significant loss in value. The definition usually includes only those investments that have a **maturity of 3 months or less from the date the company acquires the investment**. For example, if a company acquires a 20-year Treasury bond 2 months before it matures, the Treasury bond will be classified as a cash equivalent on the balance sheet and for the purposes of the statement of cash flows. However, if the company acquires a 20-year Treasury bond 2 years before its maturity date, that Treasury bond will never be classified as a cash equivalent on the company's balance sheet or statement of cash flows, even when it reaches 3 months before its maturity date, because its maturity date was not within 3 months **of the date it was acquired**.

Common examples of cash equivalents are money market funds, commercial paper and Treasury Bills.

In the preparation of the statement of cash flows, cash equivalents are considered to be cash and are therefore treated as cash. The beginning balance and ending balance of cash on the statement of cash flows includes funds classified as both cash and cash equivalents on the statement of financial position. Therefore, the **purchase or sale of cash equivalents will not be reflected in the statement of cash flows**, since those purchase and sale transactions are simply exchanging one form of cash for another form of cash.

Furthermore, in the statement of cash flows, cash and cash equivalents are to be described specifically as "cash and cash equivalents," not simply as "cash" or "funds."

### Cash Flows in Foreign Currencies

For cash flows in foreign currencies, the exchange rate that was in effect at the time of the cash flow should be used. However, if the average exchange rate gives a similar result, the average may be used.

**The following information is for the next two questions:** On November 15, 20X0, Senger Sewing Machine Corp. purchased a \$300,000 U.S. Treasury bond with a maturity date of January 31, 20X1. On December 31, 20X0, Senger still owned the Treasury bond. The company also had the following other balances on December 31, 20X0:

Checking account, ABC National Bank	\$ 50,000
Money market account, ABC National Bank	100,000
U.S. Treasury bill purchased Nov. 1, 20X0, maturing Feb. 28, 20X1	500,000

Senger treats all highly liquid investments with maturities of three months or less when purchased as cash equivalents.

Question 17: What amount should Senger report as cash and cash equivalents on its December 31, 20X0 statement of financial position (balance sheet)?

- a) \$150,000
- b) \$650,000
- c) \$450,000
- d) \$950,000

Question 18: On Senger's statement of cash flows for December 31, 20X0, how should the U.S. Treasury bond be reported?

- a) It should not be included.
- b) As a cash outflow from investing activities.
- c) As a cash outflow from lending activities.
- d) As a part of the cash and cash equivalents ending balance.

(HOCK)

Question 19: An accountant with Nasbo Enterprises Inc. has gathered the following information in order to prepare the statement of cash flows for the current year. Net income of \$456,900 includes a deduction of \$45,600 for depreciation expense. The company issued \$300,000 of dividends this year and purchased one new building for \$275,000. The balance sheets from the current period and prior period included the following balances.

	<u>Prior Year</u>	<u>Current Year</u>
Accounts receivable, net	\$ 56,860	\$ 45,300
Accounts payable	12,900	10,745
Inventory	186,700	194,320

Using the indirect method, what is the amount of cash provided by operating activities?

- a) \$202,500
- b) \$405,205
- c) \$504,285
- d) \$521,405

(ICMA 2013-2)

### Example of Statement of Cash Flows

The following set of balance sheets, income statements and statements of cash flows are presented as an example. The statements of cash flows are prepared using the indirect method and so include the reconciliations of net income to net cash provided by operating activities.

**We recommend that you review these to make sure you understand where the amounts in the statements of cash flows come from.**

**Note:** For simplicity's sake, we have assumed no changes took place in the market values of available-for-sale securities during their holding periods. The company in this example has no accumulated other comprehensive income on its balance sheet in the equity section.

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**BALANCE SHEETS**

<b>In Thousands</b>	<b>Dec. 31, Year 3</b>	<b>Dec. 31, Year 2</b>	<b>Dec. 31, Year 1</b>
<b>Current assets:</b>			
Cash and cash equivalents	\$ 3,909	\$ 2,289	\$ 2,400
Marketable securities: trading securities	7,400	4,500	4,100
Marketable securities: available-for-sale sec.	6,700	4,800	5,200
Accounts receivable, gross	722	3,700	724
Allowance for uncollectible accounts	( 22)	( 25)	( 24)
Inventories	400	500	500
Deferred tax assets	100	300	400
Prepays	<u>200</u>	<u>500</u>	<u>600</u>
Total current assets	\$19,409	\$16,564	\$13,900
<b>Long-term assets:</b>			
Deferred tax assets	\$ 800	\$ 800	\$ 300
Property, plant and equipment, net	2,400	2,100	1,800
Goodwill	1,500	1,500	1,300
Other intangible assets, net	3,000	3,100	700
Other assets	<u>400</u>	<u>400</u>	<u>300</u>
Total long-term assets	\$ 8,100	\$ 7,900	\$ 4,400
Total assets	\$27,509	\$24,464	\$18,300
<b>Current liabilities:</b>			
Accounts payable	\$ 600	\$ 500	\$ 700
Payroll and other benefits related liabilities	500	400	300
Unearned revenues	400	400	300
Other current liabilities	<u>1,300</u>	<u>1,100</u>	<u>1,000</u>
Total current liabilities	\$ 2,800	\$ 2,400	\$ 2,300
<b>Long-term liabilities:</b>			
Long-term debt-bonds due 8/1/Year 10 @ 8.0%	\$ 5,000	\$ 5,000	\$ 5,000
Unearned revenues	3,400	3,000	100
Income taxes payable	100	200	0
Other liabilities	<u>800</u>	<u>300</u>	<u>300</u>
Total long-term liabilities	\$ 9,300	\$ 8,500	\$ 5,400
Total liabilities	\$12,100	\$10,900	\$ 7,700
<b>Stockholders' equity:</b>			
Preferred stock, 5% cumulative, \$100 par value; 1,000 shares authorized and outstanding	\$ 100	\$ 100	\$ 100
Common stock, \$1.00 par value; 6,000,000 shares authorized; 1,685,000 shares issued and outstanding at Dec. 31, Year 3, 1,670,000 at Dec. 31, Year 2, and 1,650,000 at Dec. 31, Year 1	1,685	1,670	1,650
Paid-in capital	5,780	5,570	5,310
Retained earnings	<u>7,844</u>	<u>6,224</u>	<u>3,540</u>
Total stockholders' equity	\$15,409	\$13,564	\$10,600
Total liabilities and stockholders' equity	\$27,509	\$24,464	\$18,300

**INCOME STATEMENTS**

<b>In Thousands, except Per Share data</b>	<b>Year Ended Dec. 31, Year 3</b>	<b>Year Ended Dec. 31, Year 2</b>	<b>Year Ended Dec. 31, Year 1</b>
<b>Revenues:</b>			
Net revenues	\$10,400	\$11,100	\$ 9,900
Cost of goods sold	<u>3,200</u>	<u>3,400</u>	<u>3,000</u>
Gross profit	\$ 7,200	\$ 7,700	\$ 6,900
<b>Operating expenses:</b>			
Research and development	\$ 3,000	\$ 1,800	\$ 1,200
Selling, general and administrative	<u>1,500</u>	<u>1,700</u>	<u>1,400</u>
Total operating expenses	\$ 4,500	\$ 3,500	\$ 2,600
Operating income	\$ 2,700	\$ 4,200	\$ 4,300
<b>Non-operating gains/(losses):</b>			
Realized gains/(losses) on trading securities	300	500	100
Unrealized gains/(losses)-trading securities	100	200	200
Realized gains/(losses)-available for sale securities	( 44)	290	320
<b>Financial income:</b>			
Interest and dividend income	<u>177</u>	<u>129</u>	<u>118</u>
Earnings Before Interest and Taxes (EBIT)	\$ 3,233	\$ 5,319	\$ 5,038
Interest Expense	( 400)	( 400)	( 400)
Earnings Before Taxes (EBT)	\$ 2,833	\$ 4,919	\$ 4,638
Income tax expense (25% of EBT)	( 708)	( 1,230)	( 1,160)
Net income	\$ 2,125	\$ 3,689	\$ 3,478
Basic earnings per common share	\$ 1.26	\$ 2.21	\$ 2.11
Diluted earnings per common share	\$ 1.26	\$ 2.20	\$ 2.11
<b>Weighted Average No. of Common Shares used in calculating earnings and dividends per share:</b>			
Basic	1,680	1,667	1,645
Diluted	1,680	1,672	1,645
<b>Information from Notes to the Financial Statements:</b>			
The preferred stock has a par value of	100	100	100
Year-end market price per common share	\$13.00	\$31.00	\$32.00
Number of new common shares issued	15,000	20,000	10,000
Average market price per common share	\$22.00	\$31.50	\$33.00
Stock options for the purchase of 50,000 shares at an exercise price of \$28.50 per share were issued to employees on January 1, Year 2. The options vested and were exercisable in one year, on January 1, Year 3. None were exercised during Year 2 since they were not yet vested. None were exercised during Year 3.			
Essentially all sales are credit sales.			
Credit purchases (for inventory and other expenses)	6,000	8,400	4,200
Operating lease payments expensed	250	150	100
Total depreciation & amortization expensed	565	620	490
Total preferred dividends paid	5	5	5
Total common dividends paid	500	1,000	860
Annual common dividend per share	\$0.30	\$0.60	\$0.52
Trading securities sold:			
Cost	3,000	2,400	1,400
Realized gain/(loss)	300	500	100
Available for sale securities sold:			
Cost	1,000	400	1,000
Realized gain/(loss)	( 44)	290	320

## STATEMENTS OF CASH FLOWS

	Year Ended Dec. 31, Year 3	Year Ended Dec. 31, Year 2
<b>Net Income</b>	<b>\$ 2,125</b>	<b>\$ 3,689</b>
<b>Adjustments to reconcile net income to net cash provided by operating activities:</b>		
Realized (gains)/losses on available for sale securities	44	( 290)
Realized (gains)/losses on trading securities	( 300)	( 500)
Proceeds from sale of trading securities	3,300	2,900
Purchases of trading securities	( 5,800)	( 2,600)
Unrealized (gains)/losses on trading securities	( 100)	( 200)
Depreciation expense (noncash expense)	565	620
(Increase) decrease in accounts receivable	2,975	( 2,975)
(Increase) decrease in inventories	100	0
(Increase) decrease in prepaids	300	100
(Increase) decrease in deferred tax assets-current	200	100
Increase (decrease) in accounts payable	100	( 200)
Increase (decrease) in accrued payroll & benefits	100	100
Increase (decrease) in unearned revenues-current	0	100
Increase (decrease) in other current liabilities	200	100
Increase (decrease) in income taxes payable	( 100)	200
(Increase) decrease in other assets-LT	0	( 100)
(Increase) decrease in deferred tax assets-LT	0	( 500)
Increase (decrease) in unearned revenues-LT	400	2,900
Increase (decrease) in other long-term liabilities	500	0
<b>Net cash provided by operating activities</b>	<b>\$ 4,609</b>	<b>\$ 3,444</b>
<b>Investing Activities:</b>		
Purchases of available-for-sale securities (Note 1)	\$( 2,900)	\$ 0
Proceeds from sale of available-for-sale securities (Note 2)	956	690
Capital expenditures	( 865)	( 920)
Other investments-goodwill	0	( 200)
Other investments-intangibles	100	( 2,400)
<b>Net cash used by investing activities</b>	<b>\$(2,709)</b>	<b>\$(2,830)</b>
<b>Financing Activities:</b>		
Proceeds from issuance of stock	\$ 225	\$ 280
Dividends paid on common and preferred stock	( 505)	( 1,005)
<b>Net cash used by financing activities</b>	<b>\$( 280)</b>	<b>\$( 725)</b>
<b>Net cash from operating, investing and financing activities</b>	<b>\$ 1,620</b>	<b>\$( 111)</b>
Cash and Cash Equivalents – End of year	\$ 3,909	\$ 2,289
Cash and Cash Equivalents - Beginning of Year	2,289	2,400
<b>Net Increase (Decrease) in Cash</b>	<b>\$ 1,620</b>	<b>\$ (111)</b>

## Information from Notes to the Financial Statements:

Cash paid in taxes	808	1,030
Cash paid in interest	400	400

Note 1: In Year 3, the beginning balance of available-for-sale securities was \$4,800. The cost of AFS securities sold during Year 3 was \$1,000 (given in the footnotes on the income statement), and the ending balance of AFS securities was \$6,700. Letting P stand for Purchases:  $\$4,800 + P - \$1,000 = \$6,700$ . Solving for P, we get  $P = \$2,900$ . For Year 2, beginning AFS was \$5,200, the cost of AFS securities sold during Year 2 was \$400, and the ending balance was \$4,800.  $\$5,200 + P - \$400 = \$4,800$ , and  $P = \$0$ .

Note 2: Calculated using the information in the footnotes on the income statement on the cost of sold available-for-sale securities and the gain or loss on the sales. For Year 3, sold securities with a cost of \$1,000 minus the \$44 loss on the sales equals the proceeds of \$956. For Year 2, cost of \$400 plus the \$290 gain equals the proceeds of \$690.

## Statement of Comprehensive Income

U.S. Generally Accepted Accounting Principles (GAAP) are based on **comprehensive income**. Comprehensive income includes all transactions of the company **except for those transactions that are made with the owners of the company** (such as distribution of dividends or the sale of shares).

Thus, comprehensive income is the change in equity (net assets) of an entity during a period from transactions and other events and circumstances from non-owner sources. It includes **all** changes in equity during a period except those resulting from investments by owners and distributions to owners.

Comprehensive income includes everything on the income statement **plus** some things that do not appear on the income statement. Therefore, it is more inclusive than traditional net income. An example of an item that is comprehensive income but which does not appear on the income statement is unrealized holding gains and losses on available-for-sale securities. These gains and losses are not included in net income but they are included in comprehensive income. **Accumulated other comprehensive income** is a line in the equity section of the balance sheet that includes these items that are not reflected on the income statement.

According to ASC 220-10-45-1, a company has the option to report comprehensive income either in a single continuous financial statement or in two separate but consecutive financial statements.

- If the company chooses to present a single continuous financial statement, it must present it in two sections, net income and other comprehensive income. It must present
  - total net income along with the components that make up net income; and
  - a total amount for the other comprehensive income along with the components that make up other comprehensive income.
- If the company chooses to present two separate but consecutive financial statements, it must present
  - Total net income and the components of net income in the statement of net income; and
  - Total other comprehensive income and the components of other comprehensive income in a statement of other comprehensive income that immediately follows the statement of net income. The statement of other comprehensive income must begin with net income.

The items that are considered **other comprehensive income items** are expressly stated in the standards. The four items currently in this group include:

- Foreign currency translation adjustments,
- Gains or losses and prior service costs or credits related to a defined benefit pension plan that have not been recognized as components of net periodic benefit cost,
- Unrealized holding gains or losses on available-for-sale securities, and
- The effective portion of the gain or loss on a derivative designated as a cash flow hedge.

These four items may be shown as either net of tax or not net of tax. However, if they are not shown net of tax, the tax effects of these items must be disclosed separately.

If a company does not have any items of other comprehensive income in any period presented, it is not required to prepare a statement of other comprehensive income.

A company must report the accumulated balance of the items of other comprehensive income **on the balance sheet as an element of owners' equity**. Accumulated other comprehensive income should be reported separately from stock, additional-paid-in-capital (APIC) and retained earnings.

However, the components of other comprehensive income may not be presented only as part of the statement of changes in stockholders' equity. They must be reported as described above.

**Exam Tip:** It is very possible for a company to have none of these four items. However, for the exam you need to be able to identify the items that are included as Other Comprehensive Income items.

## Statement of Changes in Stockholders' Equity

The statement of changes in stockholders' equity reports the changes in each stockholders' equity account and in total stockholders' equity during the year and reconciles the beginning balance in each account with the ending balance. Since stockholders' equity accounts are permanent accounts that keep on accumulating their balances from year to year, information about the sources of changes in the separate accounts is required to make the financial statements sufficiently informative.

The statement of changes in stockholders' equity is prepared in columnar form, with a column for each individual account and a column for total stockholders' equity. The first line contains the beginning balances; the sources of the changes are on lines below and identified in the leftmost column; and the final line contains the ending balances in each account. A statement of changes in stockholders' equity should be prepared for every year that comparative financial statements are presented. One statement can be prepared for all the years to be presented, showing beginning balances, activity, and ending balances for each year. The ending balance for each year simply becomes the beginning balance for the subsequent year.

An example of a statement of changes in stockholders' equity follows, using the information given previously for the example of a statement of cash flows.

### Example of a Statement of Changes in Stockholders' Equity

#### STATEMENTS OF CHANGES IN STOCKHOLDERS' EQUITY

	Preferred Stock	Common Stock	Additional Paid-in Capital	Retained Earnings	Accumulated Other Comprehen- sive Income	Total
<b>Balance, December 31, Year 1</b>	100	1,650	5,310	3,540	0	10,600
Net income				3,689		3,689
Preferred dividends paid				(5)		(5)
Common dividends paid				(1,000)		(1,000)
Issuance of common stock		20	260			280
<b>Balance, December 31, Year 2</b>	100	1,670	5,570	6,224	0	13,564
Net income				2,125		2,125
Preferred dividends paid				(5)		(5)
Common dividends paid				(500)		(500)
Issuance of common stock		15	210			225
<b>Balance, December 31, Year 3</b>	100	1,685	5,780	7,844	0	15,409



## Limitations of Financial Statements in General

Limitations of financial statements in general include:

- Measurements are made in terms of money, so qualitative aspects of a firm are not included.
- Information supplied by financial reporting involves estimation, classification, summarization, judgment, and allocation.
- Financial statements primarily reflect transactions that have already occurred; consequently, many aspects of them are based on historical cost.
- Only transactions involving an entity being reported upon are reflected in that entity's financial reports. However, transactions of other entities such as competitors may be very important.
- Financial statements are based on the going-concern assumption. If that assumption is invalid and the business is facing liquidation, the appropriate attribute for measuring financial statement items is liquidation value. It is not historical cost, fair value, net realizable value, or any other valuation measure used for a going-concern's financial statements.

Question 20: Comprehensive income is **best** defined as

- a) net income excluding extraordinary gains and losses.
- b) the change in net assets for the period including contributions by owners and distributions to owners.
- c) total revenues minus total expenses.
- d) the change in net assets for the period excluding owner transactions.

(CMA Adapted)

## Recognition, Measurement, Valuation and Disclosure

### Accounts Receivable

#### Recognition of Accounts Receivable

The timing of recognition of accounts receivable is closely related to the recognition of revenue, since a receivable is created at the same time as a sale is recorded unless payment for the sale is received in cash. Revenue recognition is covered later in this textbook. Other than revenue recognition issues, the issue of accounts receivable recognition is one of timing of order fulfillment.

#### Goods in Transit

When goods are shipped near the end of a period, the question arises of whether the items in transit should be deemed a sale and thus revenue and a receivable recorded, or whether the items in transit should be considered to still be in inventory. That question will be answered by looking at the shipping terms.

- If the goods are shipped **FOB Shipping Point**, the seller should recognize revenue and a receivable at the time the goods are delivered to the carrier. Under FOB Shipping Point terms, ownership of the goods transfers to the buyer when the goods are delivered to the carrier. Thus, the seller will write the inventory off its books and recognize revenue and a receivable as soon as the goods are turned over to the carrier.
- If the goods are shipped **FOB Destination**, the transfer of the goods will not take place until the goods reach the buyer, so the seller will not recognize revenue or a receivable until the goods have been delivered to the buyer by the carrier.

**Note:** In a situation involving goods in transit, the seller will recognize revenue at the same time the inventory transfers from the seller to the buyer. If the inventory is still on the books of the seller, the company cannot recognize revenue because it has not yet sold anything.

The associated cost of goods sold must be recognized in the same period as the revenue is recognized. For the seller, the cost of the goods should either be recognized as inventory or as cost of goods sold. Until the revenue is recognized, the cost of the goods remains in inventory. Upon its sale, the cost of the goods becomes cost of goods sold. The cost of the goods must be one or the other. It cannot be both or neither.

#### Valuation of Accounts Receivable

For financial statement presentation, short-term receivables are valued and reported at **net realizable value**, or the net amount expected to be received in cash. The net amount expected to be received in cash may be different from the amount legally receivable.

Determining net realizable value involves estimation of (1) uncollectible receivables, and (2) any returns or allowances to be granted.

We all know that, unfortunately, some of a company's receivables will not actually be collected. This may happen because a customer goes bankrupt, there is a disputed amount, or the customer simply fails to pay for some other reason. Because an asset recorded on the balance sheet should reflect the amount of future benefit that will come to the company, a company needs to make sure that its assets are not overstated (this is the principle of conservatism). The company accomplishes this by **valuing the receivables** at year end by estimating the amount of receivables that it will actually collect in the future. This expected amount is what the company should present on the balance sheet.

This valuation is done by means of a valuation account. The valuation allowance decreases the carrying amount of the receivables as presented on the balance sheet in recognition of the fact that not all of them will actually be received as cash. The valuation account is a contra-asset account called "Allowance for Uncollectible Receivables" or "Allowance for Doubtful Debts" or some similar title. The allowance account

should have a negative balance, and, when combined with the gross accounts receivable account, it serves to decrease the value of net accounts receivable.

The valuation account is usually right next to the accounts receivable account in the general ledger. The combination of the accounts receivable account and the valuation account equal the estimated receivable amount that will be collectible. The estimated collectible amount is called "net receivables" and usually only the net receivable amount is presented on the balance sheet.

### The Allowance Methods

The two methods for estimating the amount of potentially collectible receivables are called the **percentage of sales method** and the **percentage of receivables method**. We will look at each of them in turn below, but before getting into the details we can start by saying that under both of these methods, the same things are done; it is just that the way they are calculated is different. Under both methods, we do all of the following:

- Determine the **amount of receivables that will not be collected** in the future.
- Determine the **bad debt expense** that the company needs to recognize on the income statement in this period.
- Record a debit to an expense account called bad debt expense and a credit to the allowance for doubtful debts account.

The purpose of the allowance is to recognize anticipated bad debt expense before the write-offs occur and to reduce the accounts receivable balance reported to the amount the company realistically thinks it will be able to collect.

By way of a brief outline of the two methods, below is a basic description of the process and the different approaches taken by the two methods.

### Percentage of Sales Method

The **percentage of sales** method focuses on the **amount of sales** made during the period and on determining what percentage of those sales will not be collectible. The company may use historical data or any other method that makes sense to make that determination.

Under the percentage of sales method, a company estimates the amount of its credit sales from the period that will not be collected in the future. This uncollectible amount is recognized as the bad debt expense for the period. In this method, the company uses **the income statement** to value and match the bad debt expense correctly. The ending balance in the allowance account is the beginning balance adjusted by any accounts written off during the period (debits to the allowance account) and by the bad debt expense recorded for the period (a credit to the allowance account). The ending balance in the allowance account becomes a balancing figure.

### Percentage of Receivables Method

Under the **percentage of receivables method**, a company focuses on making the **ending balance** in the allowance account be whatever it needs to be to create a net accounts receivable figure that represents the amount of receivables the company estimates are collectible. It values the ending receivables by estimating the percentage of the year-end **receivables** that will not be collected in the future. In this manner, the company uses **the balance sheet** to value the accounts receivable. The amount of bad debt expense the company records is whatever amount is needed to change the unadjusted balance in the allowance account to a balance that will create the correct net accounts receivable figure when the allowance account is combined with the accounts receivable account. (A certain amount of "working backwards" is necessary in this calculation.) Under this method, the bad debt expense figure on the income statement becomes the balancing figure.

### Comparing and Contrasting the Two Methods

The first method focuses on making the **debit to the expense account** be what it needs to be, and the balance in the Allowance account follows along. The second method focuses on making the **balance in the Allowance account** be whatever it needs to be, and the debit to the Expense account follows along.

Both methods are acceptable for U.S. GAAP purposes. However, the company must use the same method every year so that there is consistency from period to period.

Under both methods, a debit is recorded to bad debt expense and a credit is recorded to the allowance account as part of the closing entries at the end of each period. However, the two methods can result in very different amounts being debited to bad debt expense and credited to the allowance account. Each company's management needs to decide for itself which method results in a more accurate valuation of its net accounts receivable, and then it needs to use that method consistently.

### The Direct Write-off Method

Another method that may be used to value receivables is the direct write-off method. Under this method, receivables are written off only when they specifically go bad. The direct write-off method is not acceptable under U.S. GAAP because it is not consistent with accrual accounting since it does not match the revenues and expenses of the company. For this reason, the direct write-off method is not satisfactory and should not be used for financial reporting purposes. However, it may be required for tax purposes. If so, it results in temporary tax differences that will result in deferred tax assets and liabilities. Deferred taxes are covered later in this textbook.

### The Allowance for Doubtful Debts T-Account

Under both methods, when an allowance is recorded, the **allowance for doubtful debts account** (the valuation account) is credited and **bad debt expense** is debited for the amount by which the valuation account is being adjusted. The difference between the two methods is which figure in the T-account (see below) we calculate directly, and which figure is a residual, or balancing figure.

Three types of journal entries are made that involve the allowance account. These journal entries are:

- 1) To record the bad debt expense for the period.
- 2) To write off a specific receivable when it becomes uncollectible.
- 3) To collect a previously written-off receivable.

Because the Allowance account is a valuation account, it is used to reduce the amount of receivables shown on the balance sheet (similar to the way accumulated depreciation reduces fixed assets). Therefore, the allowance account must carry a credit balance because it is not likely that a company will collect more from its customers than the customers owe them. Accounts receivable will be presented on the balance sheet as follows:

Accounts Receivable	\$100,000	
Less: Allowance for Doubtful Debts	<u>(3,750)</u>	\$96,250

The \$96,250 is the **net accounts receivable**, that is, gross accounts receivable (\$100,000) net of the allowance for doubtful debts.

On the exam, one of the ways to solve problems that relate to the valuation of receivables is to set up the T-account for the allowance account. There are five items in the T-account and generally the question will give you all of the numbers except for two (the items in bold below are usually given). You will need to solve for one of the two numbers that are not given and then, having solved for one of the missing numbers, you can calculate the final number. If you set these questions up in a T-account, it makes these problems much easier.

The allowance T-account looks like the following (under both methods):

**Allowance for Doubtful Debts**

<b>(2) Amount actually written off as bad debts for the year.</b>	<b>(1) Beginning balance.</b> <b>(3) Collection of previously written-off bad debts.</b> (4) Amount to be charged as bad debt expense.
	(5) Ending balance

As stated above, generally numbers 1, 2 and 3 will be given in the problem. The question will most likely ask for the amount for item 4 or 5. We will calculate one of these two items and then it is simply a matter of solving an algebraic equation for the last number (or "backing into" it).

### Allowance Account Journal Entries

We will now look at the journal entries that are used to record receivables and the different steps in this allowance/bad debt process.

**1) The Beginning Balance of the Allowance Account**

The beginning balance of the allowance account is generally given in the problem. The beginning balance must be a credit balance because the allowance account is an asset valuation account. It reduces the balance of an asset.

**2) Actually Writing Off a Receivable**

When an account finally goes bad and we become aware of the entity that is not going to pay us, we are able to write off that individual receivable. We write off the receivable with the following journal entry:

Dr    Allowance for Doubtful Debts..... X  
       Cr    Accounts Receivable..... X

The journal entry above does not record any expense because the expense was already recognized when the allowance account was set up and the bad debt expense account was debited. In fact, this entry does not even change the net accounts receivable balance.

**3) Collecting a Previously Written-off Receivable**

In some instances, a company actually collects a receivable that it had previously written off. In this case, the company makes two journal entries. The first is to reverse the writing off of the receivable that was made in 2) above. That journal entry is:

Dr    Accounts Receivable..... X  
       Cr    Allowance for Doubtful Debts..... X

The journal entry above puts the receivable back on the books so that it can now be collected and also increases the allowance account again. The allowance account must be increased because this item, which we thought was one that would not be collected, was in fact collected. So, it must be a different receivable that will not be collected and should therefore be included in the allowance account.

The second journal entry is the collection of the cash. It is:

Dr    Cash..... X  
       Cr    Accounts Receivable..... X

As you may have noticed, both of these entries involve the accounts receivable account, one a debit and the other a credit, and they are for the same amount. Therefore, we can combine these two journal entries into just one journal entry as follows:

Dr    Cash..... X  
       Cr    Allowance for Doubtful Debts..... X

#### 4) Amount To Be Charged as Bad Debt Expense

At the end of each period a journal entry will be made to record the bad debt expense. Under both methods, bad debt expense is debited and the allowance for doubtful debts account is credited. The difference between the two methods is which number will be calculated. The journal entry is:

Dr    Bad Debt Expense ..... X  
       Cr    Allowance for Doubtful Debts..... X

The allowance account is in essence a holding account. We know that someone is not going to pay us, but since we do not yet know who that person is who will not pay us, we are not able to credit any specific customer's receivable account. Therefore, this expected bad debt is "held" in the allowance account until time passes and we find out who it is that will not be paying us.

Under the **percentage of sales method**, the amount to calculate is the bad debt expense figure. It will be calculated as some percentage of the credit sales for the period. The amount of bad debt expense is credited to the allowance account (item 4 in the Allowance T-account above). Under this method, after calculating the bad debt expense and debiting the bad debt expense account, we credit the allowance account for the same amount. That credit to the allowance account determines the ending balance in the allowance account, and the ending balance in the allowance account reduces the net accounts receivable on the balance sheet.

Under the **percentage of receivables method**, the number to calculate is the required ending balance in the allowance for doubtful debts account. The ending balance in the account is item 5 in the Allowance T-account above. The amount of the credit to the allowance account is whatever amount is required to adjust the balance in the allowance account to what it needs to be (item 4 in the Allowance T-account above). The debit to the bad debt expense account is the other side of the entry.

#### 5) The Ending Balance in the Allowance Account

The ending balance in the allowance for doubtful debts account will reduce the net accounts receivable shown on the balance sheet. The allowance account must have a credit balance because it must reduce accounts receivable, not increase accounts receivable. Usually only net accounts receivable (gross accounts receivable minus the balance in the allowance account) is shown on the balance sheet.

Under the percentage of sales method, the ending balance is a residual figure. After calculating the bad debt expense amount, the ending balance in the allowance account is simply the accumulated balance of all of the items in the allowance account.

Under the percentage of receivables method, the ending balance required in the allowance account is calculated to be a percentage of ending receivables. From this required ending balance, we work backwards to determine what the bad debt expense for the period must be in order for the allowance account to have this ending balance.

**Note:** On the exam, for any allowance-related question, we strongly recommend that you solve the question by setting up the T-account for the Allowance account and then put your numbers into this structure.

Having examined the commonalities between the two methods, we will now look in more detail at each of the two methods. You need to be familiar with what is being done and how the different figures are calculated under each method.

### Percentage of Sales Method

Under the percentage of sales method, a company calculates the amount to charge as bad debt expense for the period (item 4 in the T-account) and then it can determine (solve for) the ending balance in the allowance account (item 5). The ending balance is subtracted from the gross amount of receivables to value accounts receivable on the balance sheet.

The company calculates the bad debt expense amount as some percentage of the **total credit sales made** during the period. The percentage to use is based on the company's historical information. When the company makes this calculation, it does not take into account any previous balance in the allowance account or any previously recognized bad debt expense. The company is simply trying to calculate the amount of this period's credit sales that it will not collect and that should therefore be recognized as expense for this period.

This method is the **Income Statement Approach** because its goal is to match expenses incurred with the revenues that they are related to.

The journal entry looks like the following:

Dr	Bad Debt Expense .....	X
	Cr Allowance for Doubtful Debts .....	X

Where X = the amount of bad debt expense calculated from total credit sales.

Under both methods, the balance at the end of the year in the allowance for doubtful debts account is the accumulated balance of all of the items in the allowance account.

The T-account for the percentage of sales method is below.

#### Allowance for Doubtful Accounts - % of Sales

(2) Amount actually written off as bad debts for the year.	(1) Beginning balance.
	(3) Collection of previously written-off bad debts.
	(4) Amount to be charged as bad debt expense for the period <b>as calculated</b> from the amount of credit sales.
	(5) Ending balance ( <b>residual figure</b> ).

The steps in the percentage of sales method are as follows:

- 1) Calculate the bad debt expense for the period as a percentage of total credit sales.
- 2) Make the journal entry to debit bad debt expense for the calculated bad debt expense amount and credit the allowance for doubtful debts for the same amount.
- 3) Calculate the ending balance in the allowance account.
- 4) Check the reasonableness of the allowance account balance.

### Percentage of Receivables Method

Under the percentage of receivables method a company calculates what the ending balance in the allowance account (item 5 in the Allowance T-account) needs to be and then determines the amount to be credited to the allowance account to bring the ending balance to the required amount. The bad debt expense account is debited for the same amount.

The ending balance in the allowance account is calculated as **some percentage of all of the receivables** that are outstanding at year end. Using the same T-account shown earlier, the bad debt expense will be the amount of the **adjustment** that is required in the allowance account in order to bring the account balance to the required year-end balance as calculated.

The percentage of receivables method is a **balance sheet approach** because its goal is to value the ending accounts receivable at their net recoverable amount. This method emphasizes **asset valuation**.

The journal entry looks like the following:

Dr	Bad Debt Expense .....	Y
	Cr Allowance for Doubtful Debts.....	Y

Where Y = the **amount of change** needed in the allowance account to adjust the ending balance in the account to the required balance.

**Note:** If the allowance that is required at the end of a year is less than what is already in the allowance account at year end, the bad debt expense recognized is actually a **reduction** of bad debt expense, or a gain. This situation will arise if the previous estimates of uncollectible receivables were too high and the company actually collected more of its receivables than anticipated.

Under the percentage of receivables method, a company calculates what the allowance for doubtful debts balance **should be** at the end of the period, and the required balancing figure becomes the bad debt expense amount.

The T-account for the Percentage of Accounts Receivable Method is below.

**Allowance for Doubtful Accounts - Percentage of receivables**

	(1) Beginning balance.
(2) Amount actually written off as bad debts for the year.	(3) Amount to be charged as bad debt expense for the period ( <b>residual figure</b> ).
	(4) Collection of previously written-off bad debts.
	(5) Ending balance <b>calculated</b> using ending A/R.

The steps in the percentage of receivables method are:

- 1) Calculate what the ending balance in the allowance account should be using some percentage of ending accounts receivable.
- 2) Determine what the "plug figure" in the allowance account needs to be in order for the ending balance in the account to be as calculated in Step 1. This "plug figure" is the bad debt expense for the period.
- 3) Make the journal entry to debit bad debt expense for the amount calculated as bad debt expense in Step 2 and credit the allowance for doubtful debts account for the same amount.

**Note:** An **accounts receivable aging** report can be used to determine the required ending balance in the allowance account. An accounts receivable aging report groups the receivables by their past due status, showing the balances that are 0-30 days past due, 30-60 days past due, 60-90 days past due, and so forth. Different percentages of estimated uncollectible amounts can be applied to each group of receivables to determine what the ending balance in the allowance account needs to be. The result can be a more accurate estimate of uncollectible balances.



Question 21: Johnson Company uses the allowance method to account for uncollectible accounts receivable. After recording the estimate of uncollectible accounts expense for the current year, Johnson decided to write off in the current year the \$10,000 account of a customer who had filed for bankruptcy. What effect does this write-off have on the company's current net income and total current assets, respectively?

	<u>Net Income</u>	<u>Total Current Assets</u>
a)	Decrease	Decrease
b)	No effect	Decrease
c)	Decrease	No effect
d)	No effect	No effect

(CMA Adapted)

Question 22: Fidler Company has estimated its bad debt expense by using 1% of net sales. However, the company is contemplating aging its accounts receivable and using this as a basis for estimating its bad debts, as it is believed that this will provide a better estimate of the uncollectible accounts. The following aging schedule was prepared as of November 30 of the current year, the end of the fiscal year.

<u>Age of Account</u>	<u>Amount</u>	<u>% Estimated To Be Uncollectible</u>
Under 60 days	\$730,000	1%
61-90 days	40,000	6%
91-120 days	18,000	9%
Over 120 days	72,000	25%

Net sales for the year were \$4,200,000. There is a debit balance of \$14,000 in the allowance for uncollectible accounts as of November 30 of the current year.

If Fidler estimates its bad debts by aging the accounts receivable, the adjusting entry to the allowance for uncollectible accounts made on November 30 of the current year will be for

- a) \$56,000
- b) \$43,320
- c) \$29,320
- d) \$15,320

(CMA Adapted)

Question 23: Based on the industry average, Davis Corporation estimates that its bad debts should average 3% of credit sales. The balance in the Allowance for Uncollectible Accounts at the beginning of Year 3 was \$140,000. During Year 3, credit sales totaled \$10,000,000, accounts of \$100,000 were deemed to be uncollectible, and payment was received on a \$20,000 account that had previously been written off as uncollectible. The entry to record bad debt expense at the end of Year 3 would include a credit to the Allowance for Uncollectible Accounts of

- a) \$300,000
- b) \$260,000
- c) \$240,000
- d) \$160,000

(CMA Adapted)

Question 24: The following information is available for a small retailer:

Beginning Balances:

Accounts Receivable	\$10,000
Allowance for uncollectible accounts	(750)
Accounts Receivable, net	\$9,250

Transactions during the period:

Credit Sales	\$60,000
Collections on credit sales	55,000

During the period, Accounts Receivable totaling \$1,000 were written off as uncollectible. This brought the balance in the Allowance account to a debit balance of \$250.

**Required:** Calculate the ending balance in the Allowance account and the amount that is charged to Bad Debt Expense using the following methods:

a. **Percentage of Sales** - Assume that 3% of credit sales is the estimated bad debt expense.

b. **Percentage of Outstanding Receivables** - Assume that 6% of the outstanding receivables are estimated to be uncollectible.

(HOCK)

### Receivables as an Immediate Source of Cash: Factoring

At times a company that holds a receivable will be in need of cash immediately. When this situation arises, one of the company's options is to "sell" its accounts receivable. Factoring is the most frequently used form of selling receivables.

When accounts receivable are sold to a third party, it is called **factoring**. A commercial finance company called a **factor** essentially makes a loan guaranteed (collateralized) by the receivables to the seller of the receivables. The factor notifies the seller's customers to remit their payments directly to the factor. The factor receives repayment of the loan as it collects the receivables.

Traditionally, factoring is **without recourse**. Without recourse means that the factor assumes the risk of any inability to collect the receivables. If a sold receivable proves to be uncollectible, the purchaser (the factor) has no recourse against the seller—the loss is the factor's loss. Some companies factor their receivables primarily for the purpose of transferring the bad debt risk in this manner.

Sometimes, though, the sale is **with recourse**, meaning that if a customer does not pay the receivable, the seller of the receivable is liable to the factor for the uncollectible amount. When a factor purchases receivables with recourse, the factor's risk of uncollectibility is limited.

**Note:** If receivables are factored with recourse, the seller will carry a liability, *Recourse Obligation*, on its balance sheet for the estimated amount of any uncollectible receivables. The treatment of the recourse obligation will be explained later.

The factor charges a commission, called a factoring fee, usually of between 1% and 3% of the receivables sold. The factoring fee covers administrative costs and, if the receivables are sold without recourse, the factoring fee will be higher because it will also cover the risk of nonpayment. Thus when receivables are sold without recourse, the factoring fee is higher.

The funds available to the seller from the factoring are deposited to the seller's account with the factor. The seller of the receivables may leave the funds on deposit with the factor until the average maturity date of the receivables, or the seller may withdraw the funds before the receivables' maturity date. If the seller withdraws the funds before the receivables' maturity date, the seller is utilizing the factor's lending function and will owe interest on the funds advanced. If the seller leaves the funds on deposit until the average maturity date of the receivables, the seller will owe no interest.

The factor does not credit the seller for the full face value of the receivables it purchases. The factor deducts its factoring fee and holds back a percentage of the receivables to cover merchandise that may be returned to the seller, because receivables for returns will not be collectible by the factor. The factor's holdback is considered to represent receivables "retained" by the seller. At the end of the return privilege period, any amount not used by the factor to cover returns will be paid to the seller.

**Example:** LMN Company sells a group of its receivables with a face value of \$100,000 to a factor without recourse. The factoring fee is 3%. The factor holds back 5% of the face value of the receivables to cover customer returns. The weighted average number of days to the receivables maturity is 25 days. The factor credits LMN's account for \$92,000 (\$100,000 less the \$3,000 factoring fee and less the \$5,000 holdback). If LMN wants to draw on the account before the 25 days are up, LMN will be making use of the factor's lending function and will pay interest at the rate of 18% per annum on the funds advanced.

If LMN withdraws the funds from its account with the factor immediately, LMN will pay interest of \$1,134 ( $\$92,000 \times 0.18 \div 365 \times 25$ ). The interest will be deducted from the amount LMN can withdraw, since the "repayment" date—25 days in the future—is known.

The calculations for factoring of receivables are as follows when the seller of the receivables does not take an advance against the receivables immediately and thus no interest is charged:

- Face value of the accounts receivable
- Factoring fee<sup>15</sup> (a percentage of the face value of the receivables)
- Factor's holdback for merchandise returns (a percentage of the face value of the receivables)
- = **Funds deposited to the seller's account with the factor**

If the seller of the receivables withdraws the funds in the account immediately, the factor charges interest on the advance. The interest is prepaid, so the amount available to the seller to withdraw is reduced by the amount of the interest charged.

- Face value of the accounts receivable
- Factoring fee<sup>16</sup> (a percentage of the face value of the receivables)
- Factor's holdback for merchandise returns (a percentage of the face value of the receivables)
- = **Funds deposited to the seller's account with the factor**
- Interest expense (Funds withdrawn  $\times$  annual interest rate<sup>17</sup>  $\div$  360 days<sup>18</sup>  $\times$  the weighted average number of days to maturity of the receivables sold<sup>19</sup>)
- = **Cash available to the seller to withdraw**

If the seller of the receivables does not withdraw the funds before the maturity date of the receivables sold, no interest is charged. Another alternative available to the firm is to leave the funds on deposit in its factoring account beyond the weighted average maturity date of the receivables sold and receive interest on the funds for the period left on deposit beyond the receivables' maturity.

When the seller of the receivables records the sale, if the sale is without recourse, any allowance for bad debts already recorded for the receivables by the seller needs to be reversed.

The first example below (a sale without recourse) does not include a charge for interest expense in addition to the factoring fee because funds are not withdrawn in advance of the receivables' average maturity date. The second example (a sale with recourse) does include a charge for interest expense in addition to the factoring fee because the company takes advantage of the factor's lending function.

Interest expense may or may not be charged on any factoring arrangement, whether the sale of the receivables is with recourse or without recourse. Whether interest is charged or not depends upon whether an advance against the receivables is taken by the seller.

<sup>15</sup> The factoring fee is usually a percentage of the receivables sold. For example, if a \$100,000 receivable is sold and the factoring fee is 3%, the factoring fee will be \$3,000.

<sup>16</sup> The factoring fee is usually a percentage of the receivables sold. For example, if a \$100,000 receivable is sold and the factoring fee is 3%, the factoring fee will be \$3,000.

<sup>17</sup> This is the annual interest rate the factor is charging the seller and it will be given in the problem. It is usually higher than the normal interest rate and will be higher the greater the risk associated with the receivables.

<sup>18</sup> The number of days used for annualizing the interest may be 365 or it may be 360. Most commercial financing uses 360 days.

<sup>19</sup> This is the time period between the sale of the receivables and the weighted average maturity of the receivables.

**Example of a sale without recourse:** LMN Company sells a group of its receivables without recourse to a factor. The face value of the sold receivables is \$100,000. The factoring fee is 3%. The factor will hold back 5% of the receivables' face value to cover any merchandise returns. In this example, no interest in addition to the factoring fee is charged because LMN does not take an advance on the receivables.

The funds deposited to LMN Company's factoring account on the date of the sale are as follows:

Face value of the receivables	\$100,000
Less: Factoring fee - 3% of \$100,000	3,000
Less: Receivable from factor (factor's holdback) - 5% of \$100,000	<u>5,000</u>
Funds deposited to LMN's factoring account	\$ 92,000

The journal entries to record the sale of the receivables will be:

Dr	Deposit account with factor .....	92,000
Dr	Loss on sale of receivables .....	3,000
Dr	Receivable from factor .....	5,000
Cr	Accounts receivable .....	100,000

If LMN had had an allowance for doubtful accounts set up to value these receivables before selling them, the allowance would also need to be reversed because the sale of the receivables eliminates the need for valuation. The allowance is reversed by debiting the allowance for doubtful accounts and crediting bad debt expense for the amount of the allowance attributable to the sold receivables.

If none of the sales represented by the receivables are returned, the factor will pay the \$5,000 holdback to LMN after the end of the return privilege period. In that event, LMN will debit cash and credit the receivable from factor. If a portion of the sales represented by the receivables are returned, the factor will pay the \$5,000 holdback less the returns to LMN. LMN will debit the amount of the returns to the sales returns and allowances account, debit cash for the amount of cash received, and credit the receivable from factor account for the full \$5,000.

If the receivables are factored **with recourse**, the entries will include a credit to a liability account titled recourse liability and the loss on the sale of the receivables will be greater by the amount of the recourse liability. In the following example, LMN factors the receivables with recourse and withdraws the funds available from its account with the factor and thus interest is charged.

**Example of a sale with recourse:** LMN Company sells a group of its receivables with recourse to a factor. The face value of the sold receivables is \$100,000, and LMN determines that the fair value of the recourse liability is \$3,000. The factoring fee is 1% (the fee is lower than in the previous example because this sale is with recourse). The factor will hold back 5% of the receivables' face value to cover any merchandise returns. In this example, interest of 18% per annum is charged in addition to the factoring fee because LMN takes a cash advance of the full amount available. The interest expense is calculated on the weighted average time to maturity of the receivables sold, which has been determined to be 25 days.

The funds deposited to LMN's factoring account and the cash available to LMN Company to withdraw are as follows:

Face value of the receivables	\$100,000
Less: Factoring fee - 1% of \$100,000	1,000
Less: Receivable from factor (factor's holdback) - 5% of \$100,000	<u>5,000</u>
Funds deposited to LMN's factoring account	\$94,000
Less: Prepaid interest expense charged on withdrawn funds (\$94,000 × 0.18 ÷ 360 × 25 days)	<u>1,175</u>
Cash available to LMN to withdraw	\$ 92,825

The "net proceeds" of the factoring are the cash and other assets received (the "other assets" is the receivable from the factor for the holdback) minus any liabilities incurred. The "net proceeds" of the factoring are as follows. The net proceeds will be different from the amount of cash available:

Cash received from factoring	\$92,825	
Plus: Receivable from factor (factor's holdback)	<u>5,000</u>	\$97,825
Less: Recourse liability		<u>3,000</u>
Net proceeds		\$94,825

The loss on the sale of the receivables is:

Carrying (book) value of receivables	\$100,000
Less: Net proceeds	<u>94,825</u>
Loss on sale of receivables	\$ 5,175

The \$5,175 loss consists of the factor's fee of \$1,000, the recourse liability of \$3,000, and the interest of \$1,175. The amount of the loss can be allocated among a factoring fee account (\$1,000 debit), the interest expense account (\$1,175 debit), and the loss on sale of receivables account (\$3,000 debit); or the total amount can just be debited to a loss account. Here the amounts have been segregated into different accounts.

The journal entries to record the sale of the receivables will be:

Dr	Cash (funds withdraw from factoring account) .....	92,825
Dr	Factor's fee .....	1,000
Dr	Loss on sale of receivables.....	3,000
Dr	Interest expense (or prepaid interest) .....	1,175
Dr	Receivable from factor .....	5,000
Cr	Recourse liability .....	3,000
Cr	Accounts receivable .....	100,000

If all of the receivables are collected, LMN will not need to make any payment to the factor and will simply debit the recourse liability to eliminate it and will credit income. If some of the receivables turn out to be uncollectible, LMN will debit the recourse liability and credit cash for the amount it must reimburse the factor and will debit the recourse liability and credit income for any remaining unused recourse liability.

If a portion of the sales represented by the receivables are returned, the factor will pay the \$5,000 holdback less the returns to LMN after the return privilege period. As in the previous example, LMN will debit the amount of the returns to sales returns and allowances, debit cash for the amount of cash received, and credit the receivable from factor account for the full \$5,000. If none of the sales are returned, the factor will pay the full \$5,000 to LMN after the return privilege period.

Again, if LMN had set up an allowance to value the \$100,000 in receivables it sold, it would need to also reverse that by debiting the allowance for doubtful accounts and crediting bad debt expense.

In order for a transfer of assets to be accounted for as a **sale** instead of as secured financing, the following conditions must be met:

- The company that sells the receivables must never be able to collect those receivables. Furthermore, other people and companies that the seller owes money to must never be able to take the receivables in settlement of the debt, even if the seller goes bankrupt. Those receivables must really be gone.
- The buyer (the factor) must be allowed to do whatever it wants to do with the receivables. If the factor wants to pledge the receivables as collateral for its own borrowing, it can do so. Or if the factor wants to exchange the receivables for other assets or re-sell them to some other company, it can do so.
- The seller must have no control over the receivables whatsoever. Control would still exist if the seller has signed an agreement that entitles and obligates the seller to repurchase the receivables or to pay them off before they mature, so that type of agreement cannot exist if the receivables are to be considered sold. Also, the seller must not be able to force the factor to return specific receivables.

Question 25: Woody Company sold \$150,000 of its accounts receivable without recourse. The purchaser assessed a finance charge of 5%. Woody should record

- a) Interest expense of \$7,500.
- b) A credit to liability on transferred accounts receivable of \$150,000.
- c) A credit to accounts receivable of \$150,000.
- d) A debit to cash of \$150,000.

(CMA Adapted)

Question 26: A firm often factors its accounts receivable. The finance company requires an 8% reserve and charges a 1.5% commission on the amount of the receivable. The remaining amount to be advanced is further reduced by an annual interest charge of 16%. What proceeds (rounded to the nearest dollar) will the firm receive from the finance company at the time a \$110,000 account, which is due in 60 days, is turned over to the finance company?

- a) \$81,950
- b) \$83,630
- c) \$96,895
- d) \$99,550

(CMA Adapted)

## Inventory

Inventory is a critical account in the accounting process. It is one of the most important and possibly largest items on the balance sheet for a company that either produces or sells goods. Inventory not only shows up on the balance sheet as an asset, but it is also an important item on the income statement as part of the calculation of the cost of goods sold. For a merchandising company, cost of goods sold is usually one of the largest expense items on the income statement.

Issues you need to be familiar with in regards to inventory include:

- The **valuation of the inventory** when it is purchased and recorded,
- The determination of **which specific items** of inventory are **included in inventory at year end**,
- The recognition of permanent declines in the value of the inventory by using the **lower of cost or market**, and
- The **estimation of ending inventory** amounts in situations when the ending inventory cannot be counted or for use in quarterly financial statements.

## Classifications of Inventory

A manufacturing company has three different classifications of inventory. They are:

- **Raw materials** – the individual parts and pieces that will be assembled to make the finished goods.
- **Work-in-process** – units of inventory for which production has started, but has not yet been completed.
- **Finished goods** – units that have been completed but not yet sold.

In this section, the focus is on the accounting for finished goods. The production process and the allocation of costs in the production process are covered in Section D, *Cost Management*. Here, our attention is on a merchandising company or a reseller, in other words a company that buys finished products and sells them to the consumer without doing any production. An example is an electronics store, but what is covered here is applicable to any type of good.

## Valuing the Inventory When It Is Purchased

Inventory should be recorded in the books at the amount that includes **all of the costs paid for getting the inventory ready and available for sale**. All the costs include not only the cost of the inventory itself, but also shipping costs to receive the inventory, insurance, taxes and tariffs, duties, storage and any other costs without which the company could not sell the inventory to the customer.

The journal entry to record the purchase of inventory is as follows:

Dr	Inventory .....	all costs required
	Cr	Cash.....all costs required

**Note:** If more than one type of inventory is purchased for only one purchase price, the cost needs to be allocated amongst the different inventories purchased, using a pro rata distribution based upon the **fair value of the different items purchased**.

If a company receives **any discounts** related to the purchase of the inventory, the **discounted price that it pays** is the amount that should be recorded as the value of the inventory.



**Note:** If a reseller receives goods that are shipped **FOB Destination** (meaning the goods are considered sold only when they reach their destination), the costs of shipping are incurred by the seller and not the buyer/reseller. **These shipping-out costs are considered to be a selling expense to the seller and are not included in either the inventory or the cost of goods sold figure for the reseller/buyer.** The only amount the reseller/buyer of the inventory shipped FOB Destination records as inventory is the cost of the goods themselves. All shipping related charges were paid by the seller and were most certainly included in the single invoice amount.

### What Goods Are Included in Inventory

At the end of a reporting period, the question arises as to what items should be included in ending inventory at the reporting date and what items belong to someone else and therefore should be included in their ending inventory. The questions are related to items that are consigned, in transit, or obsolete. The treatment of these different categories of goods is as follows.

#### In Transit Goods

In transit goods are goods that have been shipped prior to year end but had not yet been received by the buyer as of year end. To whom the goods belong is determined by the terms of shipping.

- Goods sent **FOB Shipping Point** belong to the buyer from the moment the seller gives them to the shipping company. Thus, while the goods are in transit they belong to the buyer because title was transferred at the shipping point.
- Goods sent **FOB Destination** belong to the shipper until the buyer receives them. While the goods are in transit, they belong to the seller and title is transferred at the destination point only when they are received by the buyer.

#### Consigned Goods

Consigned goods are given by one company (the consignor) to another company (the consignee) for that second company to sell to the end consumer. Goods may be consigned because the consignee is physically closer to the consumer or because consignment enables the consignor to get a wider distribution of goods than the company could achieve on its own.

The main issue is that when goods are consigned, **ownership never transfers to the company that receives the goods (the consignee)** to sell them to the end consumer. Title passes directly from the consignor to the end consumer. Therefore, the consignee never bears the risk of loss (unless a contract passes this risk to them). In return for selling the goods, the consignee will charge some sort of commission or fee to the consignor.

The issue we are concerned with is which company—the consignor or the consignee—should record the goods as inventory on their balance sheet. In short, the goods should be recorded as inventory on the records of the consignor company because it bears the risk of loss. The consignor company maintains the goods on its inventory records even if contractually and legally it has passed the risk of loss to the consignee.

In summary, and using some of the terminology that may appear in an exam question:

- Goods **out on consignment** belong in the inventory of the company that has put the goods out on consignment (the consignor). The goods should be carried on the consignor's balance sheet at the cost the consignee paid for the goods **plus any shipping costs** the consignor paid to get the goods to the consignee company that will sell the goods. The shipping costs to the consignee are costs of making the goods available for sale to the customer and thus are inventoriable costs.
- Goods **held on consignment** do not belong to the company that holds them (consignee) and therefore should not be included in the consignee's inventory.

### Goods Out On Approval

Goods out on approval are goods that are currently held by the customer but have not yet been purchased by the customer. The customer physically has the product and has some period of time to decide whether to purchase it or return it. Goods-out-on-approval items should be included in inventory at their original cost until the customer accepts the goods. Only when the customer accepts the goods (or the time period for return passes without the customer returning the goods) will the sale be recognized and the cost of the inventory moved from inventory to cost of goods sold.

### Obsolete Inventory

Inventory that is obsolete can no longer be sold and **should not be included in the inventory balance on the balance sheet**. Items may become obsolete for a number of reasons. Among them are: technological advancement that has made the product useless; there has been a loss of the market; there are new features in newer products; or the item must be used with another product that is no longer available for sale. Any inventory that becomes obsolete should be written off as a loss in the period in which it is determined to be obsolete.

### Determining Which Item Is Sold

Because the inventory a company holds is purchased at different times, the prices paid for individual units of the same item are different. As a result, the specific unit of inventory that is sold impacts both the balance sheet (through reduction of the inventory account) and the income statement (through increase of the cost of goods sold).

Therefore, the company must have a method of determining exactly which unit of inventory is sold for each and every sale. The company must essentially determine whether the sold unit was the oldest in inventory—purchased a long time ago; the newest unit—just purchased yesterday; or some “average” unit of inventory.

The different methods for determining which units have been sold are called **cost flow assumptions**. The four main cost flow assumptions are:

- 1) **First in First Out (FIFO)**, in which we assume that the item sold to the customer is the earliest unit purchased by the seller that has not yet been sold (in other words, the **oldest** item in inventory).
- 2) **Last in First Out (LIFO)**, in which we assume that the item sold to the customer is the latest unit purchased by the seller (in other words, the **newest** item in inventory).
- 3) **Weighted Average**, in which we sum the costs paid for all the individual units of a given item in inventory and divide by the number of units purchased to find the average cost for each unit.
- 4) **Specific Identification**, in which we actually keep track of each unit of inventory individually. The specific identification method is used for low quantity, high value inventory items, such as merchandise in a jewelry store or serialized electronic merchandise where records are kept by serial number.

Whichever cost flow assumption is used, the resulting cost of a sold unit becomes the cost that is used as the cost of goods sold for that sale.

The three most common methods are FIFO, LIFO and weighted average. We will look briefly at these in more detail below. We will not look much at specific identification because it is very simple to determine the value of what was sold and what remains on hand at year end since records are kept by individual piece. For example, many accounting systems provide the ability to track serialized inventory according to serial number, and the cost of each specific unit is attached to that unit in inventory. When an item of serialized inventory is sold, the cost attached to that specific unit of inventory is removed from inventory and transferred to cost of goods sold.

### First in First Out (FIFO)

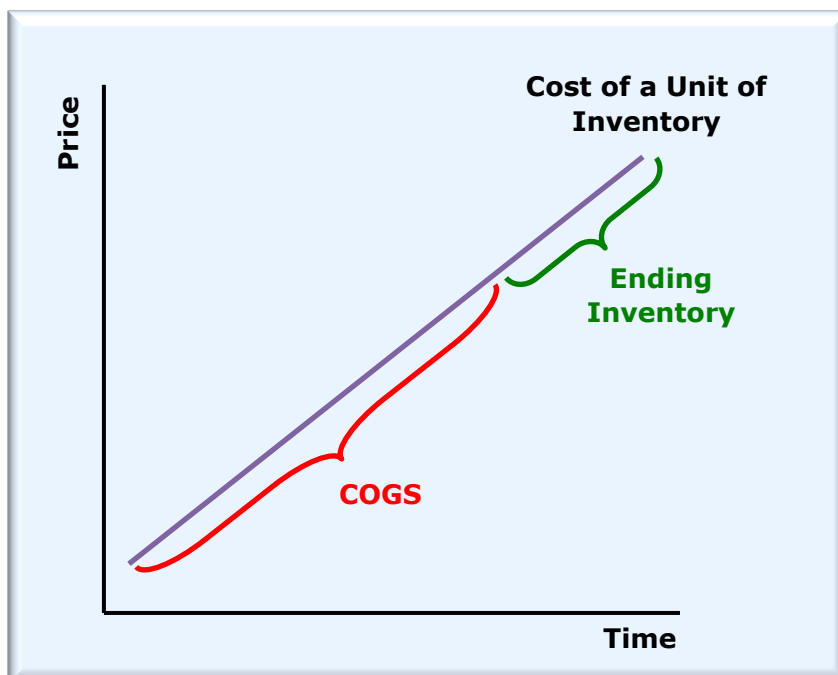
Under FIFO, the most recently purchased inventory items are included in ending inventory on the balance sheet because the company assumes that every time an item is sold, it sells the oldest item in inventory. Hence, the first item the company buys as inventory is the first item that is sold, and the oldest item in inventory is always the item that is sold.

An example of the FIFO method is a fruit stand. When someone buys an apple, the seller will try to sell the oldest apple first because, if not sold before it spoils, it will become obsolete and therefore create a loss for the fruit stand.

In a period of rising costs (an inflationary situation), use of FIFO will result in a **higher inventory** balance and a **lower COGS** (and therefore **higher profit**) when compared to LIFO (covered next). This occurs because the newest, most expensive units of inventory are still on hand at year end (higher ending inventory) and the oldest, cheapest units of inventory are what were sold during the year (lower cost of goods sold).

**Note:** Under FIFO, ending inventory is valued at current cost (or replacement cost), and cost of goods sold is reported at an older, historical cost. Therefore, the balance sheet has "current" figures on it because the inventory is valued at the current costs.

Graphically, in a period of rising prices, FIFO looks like the following:



Under FIFO, the oldest units of inventory the company purchased are sold and the newest units are considered to still be in ending inventory.

In the U.S., FIFO is the only inventory cost flow assumption that is not restricted in its usage for income tax purposes by the IRS.

### Last in First Out (LIFO)

Under LIFO, the assumption is that each time a unit is sold, the sold unit is the one that was purchased most recently—the newest item in inventory. Therefore, the oldest inventory items (and the cheapest items, assuming rising prices) will be included in ending inventory on the balance sheet.

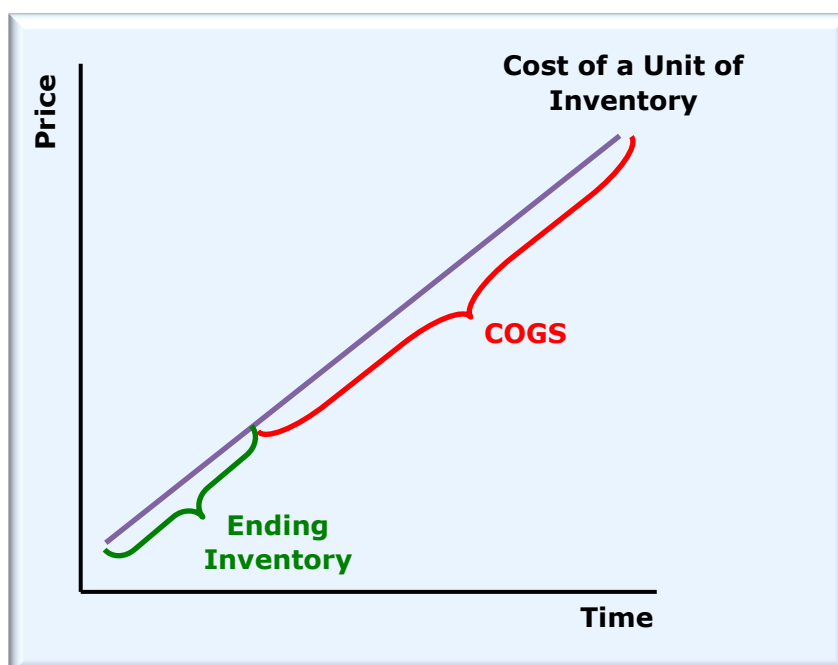
As a result, in a period of rising prices, LIFO will create a **lower ending inventory** balance and a **higher COGS** (and therefore **lower profit**) when compared to FIFO. This occurs because at year end, the oldest,

cheapest items are still in inventory and the newest, most expensive units have been sold and are on the income statement as cost of goods sold.

An example of the LIFO inventory method is an elevator (though this is not a financial illustration it demonstrates the point). The last person who gets in the elevator should be the first person who gets off of the elevator because he or she is closest to the door.

Graphically, LIFO in a period of rising prices is shown in the graph on the following page.

**Note:** Under LIFO, cost of goods sold is valued at the current cost (or replacement cost) of the inventory. Inventory is recorded on the balance sheet at an older, historical cost. Therefore, the income statement has “current” figures on it because cost of goods sold is valued at the current costs.



Whenever a sale takes place, the newest items of inventory are considered sold and are reported as cost of goods sold expense while the oldest (cheapest) units are assumed to be in ending inventory.

LIFO inventory valuation in the U.S. is actually an income tax construct. In a period of rising prices, use of LIFO can lower a company's taxable income (and thus its taxes) because the most recently purchased and most expensive units are expensed as cost of goods sold in each period. Because LIFO is primarily used for income tax purposes to lower a company's tax bill, U.S. GAAP does not provide specific rules for using LIFO. Instead, the application of LIFO is based upon income tax rules rather than on financial accounting standards. U.S. GAAP states that LIFO is an acceptable inventory method, but that is all it says.

Income tax regulations require that if a company uses LIFO on its income tax return, it must also use LIFO for its financial reporting (called **financial statement conformity**). However, there is more than one type of LIFO. A company could use one type of LIFO on its income tax return and a different type of LIFO for its financial reporting and track the differences in income tax liability between the two methods by means of deferred tax assets and liabilities.

IFRS (International Financial Reporting Standards) do not permit the use of LIFO for inventory valuation.

### Weighted Average

The weighted average method attempts to create a balance between FIFO and LIFO by using an average cost for the calculation of both ending inventory and COGS. The sum of the cost paid for all the individual units of a given item in inventory is divided by the number of units purchased to find the average cost per unit. The

ending balance for inventory and the amount of income will be somewhere in between what they would be under FIFO and LIFO.

The IRS does not permit the weighted average method to be used on a company's tax return. If a company chooses to use the weighted average method for financial reporting, it will have no choice but to use FIFO for income tax reporting. Use of the weighted average method for financial reporting and LIFO for income tax reporting is not an option, because as noted above, if LIFO is used on the income tax return, IRS regulations state that LIFO must also be used for the financial statements.

### Effect of the Different Methods

You need to be familiar with how the different systems impact the calculation of ending inventory and the cost of goods sold. You can either work this mathematically on the exam if a question requires it, or you can memorize the information in this table.

	Ending Inventory	Cost of Goods Sold	Gross Profit
<b>Rising Prices</b>	FIFO Higher	LIFO Higher	FIFO Higher
<b>Falling Prices</b>	LIFO Higher	FIFO Higher	LIFO Higher

### The Frequency of Determining Inventory Balances

In addition to making a decision regarding the inventory method (FIFO/LIFO/Weighted Average), a company also must decide how frequently it will make the necessary inventory calculations. There are two systems for the frequency of making inventory entries—the periodic method and the perpetual method. The difference between the systems is how often a company makes the calculation of its ending inventory and cost of goods sold.

#### Periodic System

Under the periodic system, entries and calculations are made **only at the end of the period** (every month, year or quarter). The graphs on the earlier pages for FIFO and LIFO are drawn under the periodic assumption.

The effects of the periodic method on the three main methods of tracking physical units of inventory are as follows.

#### FIFO in the Periodic System

At the end of the period the company determines the total number of units of inventory that it had during the period (beginning inventory + purchased during the period) and the price for each of the units in beginning inventory and the units purchased during the period. Of all of these units, ending inventory consists of the most recently purchased units, or those purchased toward the end of the year.

Because this is the periodic method, this determination is done only at the end of the period.

#### LIFO in the Periodic System

LIFO in the periodic system is similar to FIFO in the periodic system except for the determination of which units are included in ending inventory and which units were sold during the period.

At the end of the period, the company determines the total number of units of inventory that it had in total during the period (beginning inventory + purchased during the period) and the price for each of those. Of all of these units, ending inventory consists of the oldest units. This ending inventory for the period is made up of units that were in beginning inventory plus – if inventory increased during the year – the units purchased closest to the beginning of the year.

Again, because this is the periodic method, this determination is done only at the end of the period.

### Weighted Average in the Periodic System

Under the weighted average method, at the end of the period the company determines the total number of units that it had (beginning inventory + purchased during the period) and also the total cost that it paid for all of these units. By dividing the total cost by the total units, the company determines an average cost for each unit of inventory. This average cost per unit is applied to the units on hand at the end of the year as well as to the units sold in order to calculate ending inventory and COGS, respectively. Because this is the periodic method, this is done only at the end of the period.

### Perpetual System

Under the perpetual system the calculation of the cost of the item of inventory that is sold is made after each individual sale. For LIFO and the weighted average methods, the perpetual system leads to a larger number of calculations. While the calculations are not difficult, it is important that you keep track of all of the necessary information for these types of questions. The effects of the perpetual method on the three main methods of tracking physical units of inventory are outlined below.

### FIFO in the Perpetual System

Under FIFO **there are no differences between the periodic and the perpetual methods** because under FIFO, the oldest unit is sold. Regardless of whether the company determines the oldest unit at the end of the year or after each sale, the oldest unit is always the oldest unit.

**Example:** Although not financial, a family is a good example. No matter how many children are born into a family, the oldest child is always the oldest child. Whether we make this determination while more children are still being born or after all of the children are born, the oldest is always the oldest. It is the same with inventory. Regardless of when we determine the oldest unit, that unit will always be the oldest unit until it is sold.

**Note:** For the exam you need to remember that the **periodic and perpetual methods of FIFO give the same result**. This may help you save time in the calculations of a large inventory question.

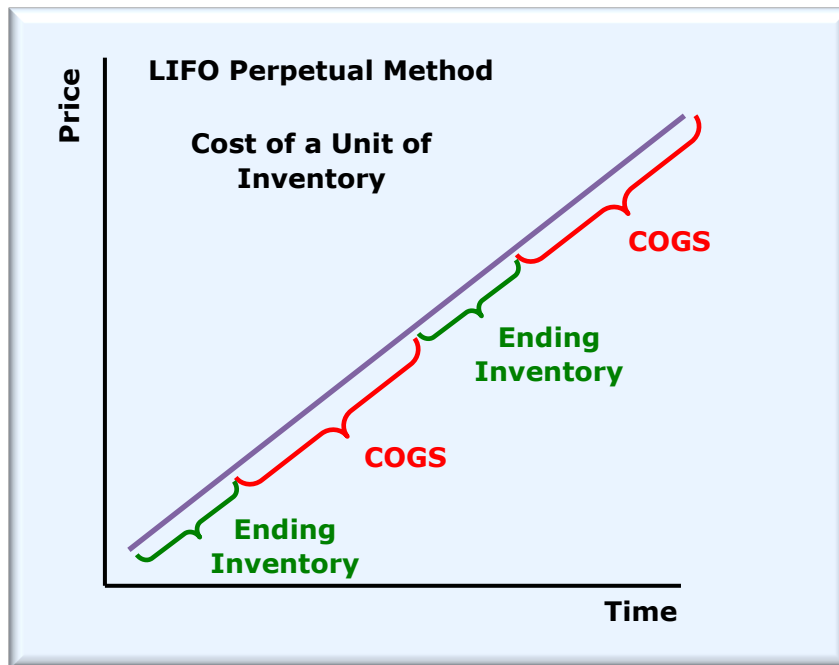
### LIFO in the Perpetual System

When using perpetual LIFO it becomes slightly more difficult to calculate the ending inventory. This is because the LIFO perpetual method creates what we call LIFO layers.

A **LIFO layer** arises when a company purchases more inventory before it sells all of its previous purchase of inventory. Because we assume in LIFO that the most recently purchased (newest) inventory item is sold, it leads to having many different individual prices for the units in ending inventory. Each time the company buys more inventory before selling all of the inventory it has on hand, a layer is added. In the graph below is a presentation of LIFO perpetual in which inventory layers are created. To simplify the presentation, we will assume that the company counts its inventory twice a year, rather than after every purchase. We will also assume that in both the first and second half of the year the company purchased more units of inventory than it sold. Therefore, at the end of the year the company will have the following ending inventory and COGS as shown on the following page.

Once a LIFO layer is created it will remain until the company reaches a period when it sells more units than it purchased. When the company sells more units than it has purchased, one or more LIFO layers may be eliminated, called a "LIFO Liquidation."

On the exam, you may have to solve a problem that deals with a company's purchases and sales over a one-month period. In this situation, it is best to actually write down the different purchases and sales and mark out which units are sold and what units remain after each sale.



Each layer will remain until it is “liquidated.” The liquidation of a layer occurs when the company sells all of the most recently purchased inventory plus some “older” inventory before purchasing more. However, you need to keep in mind that the liquidated layer will be the newest, most recently formed layer. Therefore, the first unit of each inventory item that a company purchased could theoretically still be in the company’s inventory 50+ years later.

### Moving Average in the Perpetual System

When the weighted average method is performed on a perpetual basis, the method is called the **moving average**. This is because the average that is used to apply to ending inventory and COGS is constantly changing as a result of **calculating a new average after each purchase of inventory**.

This process is not conceptually difficult, but it becomes slightly more difficult mathematically as a result of keeping track—at all times—of the current inventory in respect to both units and total cost. Each time a new purchase is made, a new average cost must be calculated, and this average cost is used until the next purchase is made, at which point a new average cost will be calculated.

**Note:** Obviously the perpetual system provides a more accurate reflection of inventory transactions, but it also requires more time and effort from the staff of the company in order to collect, input and process all of the data.

For the exam, you may need to be able to make the various calculations under FIFO, LIFO and weighted average methods. These calculations include: ending inventory, cost of goods sold and gross profit from sales. Below is an example that goes through these different calculations for each of the methods.

**Example:** Below are the March inventory purchase and sales transactions for Medina Company. Note that prices are rising.

		<u>Units</u>	<u>Cost Per Unit</u>
	Beginning Inventory	1,000	\$5.00
March 3	Purchase	1,500	6.00
March 7	Sale	900	
March 11	Sale	700	
March 20	Purchase	1,000	7.00
March 21	Sale	600	
March 29	Sale	<u>200</u>	
	Ending Inventory	<u>1,100</u>	

Calculate the ending inventory and COGS using FIFO periodic, FIFO perpetual, LIFO periodic, LIFO perpetual, weighted average periodic, and weighted average perpetual methods:

Before we start answering these questions, it will be useful for us to look at the number of units that the company had during the year and determine how many were sold (and will be in cost of goods sold) and how many units are in ending inventory.

The number of units sold is equal to 2,400. We know this because the company had 3,500 units available to sell during the year (the units in beginning inventory plus the units purchased), and there are 1,100 units in ending inventory. Therefore, 2,400 units must have been sold. We can also simply sum the units from each of the four individual sales during the month:  $900 + 700 + 600 + 200 = 2,400$ .

We know that the total value of goods available for sale during the month is \$21,000, calculated as  $(1,000 \times \$5) + (1,500 \times \$6) + (1,000 \times \$7)$ . The total of the ending inventory and the cost of goods sold must therefore be \$21,000 under all of the methods. So if we calculate the value of one of those amounts, we can determine the other simply by looking at the difference between what was calculated and \$21,000. This is shown in the explanations below.

### FIFO Periodic

For FIFO it is usually easier to calculate ending inventory. Once ending inventory is calculated, you can simply subtract the ending inventory from the total cost of all units, which in this example is \$21,000, to calculate COGS. Since there are 1,100 units in ending inventory and we are doing FIFO, the units in ending inventory are the units most recently purchased. Therefore, ending inventory is made up of 1,000 units that cost \$7 each and 100 units that cost \$6 each. This is a total of **\$7,600**. If ending inventory is \$7,600, then the COGS sold is **\$13,400** ( $\$21,000 - \$7,600$ ).

### FIFO Perpetual

For FIFO the periodic and perpetual methods give the same answers. So, the answers to the FIFO perpetual method are the same as the answers to the FIFO periodic method.

### LIFO Periodic

The values of ending inventory and COGS can be calculated in a very similar manner to the FIFO periodic method, except that the 1,100 units in ending inventory are the oldest units. Thus, ending inventory includes 1,000 units that cost \$5 each and 100 units that cost \$6 each, which equals **\$5,600**. If ending inventory is equal to \$5,600, then COGS must be equal to **\$15,400** ( $\$21,000 - \$5,600$ ).

(Continued)



**LIFO Perpetual**

LIFO perpetual is a little more involved because it is necessary to determine the COGS after each individual sale of inventory. Then after determining the total COGS amount, we can subtract this from \$21,000 to calculate the ending inventory amount. For each of the sales, the units sold and their costs are as follows:

March 7	900 units sold. The units sold are from the March 3 purchase for \$6: $\$6 \times 900 = \$5,400$ COGS.
March 11	700 units sold. 600 units are from the March 3 purchase for \$6 and 100 units are from beginning inventory at \$5: $(\$6 \times 600) + (\$5 \times 100) = \$4,100$ COGS.
March 21	600 units sold. The units are from the March 20 purchase for \$7: $\$7 \times 600 = \$4,200$ COGS.
March 29	200 units sold. The units are from the March 20 purchase for \$7: $\$7 \times 200 = \$1,400$ COGS.

The sum of  $\$5,400 + \$4,100 + \$4,200 + \$1,400 = \mathbf{\$15,100}$  for cost of goods sold during March. This means that ending inventory must be equal to **\$5,900** ( $\$21,000 - \$15,100$ ). The units that are in ending inventory include 900 from beginning inventory (\$5 each for a total of \$4,500) and 200 from the March 20 purchase (\$7 each for a total of \$1,400).

**Weighted Average (Periodic)**

The weighted average method is fairly straightforward, because we simply need to calculate an average cost for all of the units during the period. The total cost was \$21,000 and 3,500 units were available for sale. \$21,000 divided by 3,500 equals an average cost of \$6 per unit. This \$6 per unit is multiplied by the 1,100 units in ending inventory to calculate the ending inventory balance of **\$6,600** and to the 2,400 units that were sold to calculate cost of goods sold of **\$14,400**.

**Moving Average (Perpetual)**

The moving average method is the most complicated method, but still mathematical in the way it works. After each purchase it is necessary to calculate a new average cost per unit. This calculation is shown in the table below for each of the sales and purchases made during March.

Date	Units	Cost per Unit	Total Units in Inventory	Total Cost in Inventory	Avg. Cost per Unit	COGS Calculation
Mar 1	Beg. Inv.		1,000	\$ 5,000	\$5.00	
Mar 3	Buy 1,500	\$6	2,500	\$14,000	\$5.60	
Mar 7	Sell 900		1,600	\$ 8,960	\$5.60	$900 \times 5.60 = \$5,040$
Mar 11	Sell 700		900	\$ 5,040	\$5.60	$700 \times 5.60 = \$3,920$
Mar 20	Buy 1,000	\$7	1,900	\$12,040	\$6.34 *	
Mar 21	Sell 600		1,300	\$ 8,238	\$6.34	$600 \times 6.34 = \$3,802$
Mar 29	Sell 200		1,100	\$ 6,971	\$6.34	$200 \times 6.34 = \$1,267$

\* There is a small rounding error here in that the actual calculation is \$6.3368.

In summing all of the COGS items, we get **\$14,029** ( $\$5,040 + \$3,920 + \$3,802 + \$1,267$ ). The ending inventory is from the table and is the "Total Cost in Inventory" value from the last row, or **\$6,971**.

**Summary:**

	Ending Inventory	COGS	Total
FIFO Periodic	\$7,600	\$13,400	\$21,000
FIFO Perpetual	\$7,600	\$13,400	\$21,000
LIFO Periodic	\$5,600	\$15,400	\$21,000
LIFO Perpetual	\$5,900	\$15,100	\$21,000
Weighted Average Periodic	\$6,600	\$14,400	\$21,000
Moving Average Perpetual	\$6,971	\$14,029	\$21,000

(Continued)

In a period of rising prices, LIFO results in the highest cost of goods sold and thus the lowest net income of all the methods, while FIFO results in the lowest cost of goods sold and the highest net income. If prices are falling, the opposite will be true: FIFO will result in the highest cost of goods sold and the lowest net income of all the methods, while LIFO will result in the lowest cost of goods sold and the highest net income.

The resulting cost of goods sold and net income from the weighted average method will always be in between LIFO and FIFO.

Question 27: The advantage of the last-in, first-out inventory method is based on the assumption that

- a) the most recently incurred costs should be allocated to the cost of goods sold.
- b) costs should be charged to revenue in the order in which they are incurred.
- c) costs should be charged to cost of goods sold at average cost.
- d) current costs should be based on representative or normal conditions of efficiency and volume of operations.

(ICMA 2008)

Question 28: In a period of rising prices, which one of the following inventory methods usually provides the **best** matching of expenses against revenues?

- a) Weighted average
- b) First-in, first-out
- c) Last-in, first-out
- d) Specific identification

(ICMA 2008)

Question 29: Which one of the following actions would result in a decrease in income?

- a) Liquidating last-in, first-out layers of inventory when prices have been increasing.
- b) Changing from first-in, first-out to last-in, first-out inventory method when prices are decreasing.
- c) Accelerating purchases at the end of the year when using the last-in, first-out inventory method in times of rising prices.
- d) Changing the number of last-in, first-out pools.

(ICMA 2008)

Question 30: In periods of rising costs, which one of the following inventory cash flow assumptions will result in higher cost of sales?

- a) First-in, first-out
- b) Last-in, first-out
- c) Weighted average
- d) Moving average

(ICMA 2008)

Question 31: The inventory method that will yield the same inventory value and cost of goods sold whether a perpetual or periodic system is used is

- a) average cost
- b) first-in, first out.
- c) last-in, first-out.
- d) either first-in, first-out or last-in, first-out.

(ICMA 2008)

### The Physical Inventory Count

At the end of each year, a company undertakes a physical inventory count in order to actually count the number of units that are on hand at the end of the year. Once the company knows how many units are actually on hand, they will use their inventory method (FIFO or LIFO, for example) to determine the cost of those units on hand.

The result of this calculation is what will actually be recorded in the financial statements because it is the correct, actual inventory balance.

After this count is made, the company will need to make an adjusting journal entry so that the balance sheet reflects the true inventory balance.

If the actual count of inventory is less than the accounting records indicate, the journal entry to write down inventory is:

Dr	Inventory loss .....	X
Cr	Inventory .....	X

If the physical count of inventory is greater than the amount recorded in the accounting records, the value of the inventory needs to be written up. The journal entry to do this is:

Dr	Inventory .....	X
Cr	Inventory gain.....	X

**Note:** This physical count **is required by U.S. GAAP for annual reporting purposes**. Under GAAP, whatever inventory method that is used must have a physical count of the inventory done each year. The physical count is not required for interim financial statements, however.

**Note:** Some companies do not count 100 percent of their inventory at year end, but rather count some of their inventory at the end of every month, or some other time period. This is an acceptable method and makes the counting of inventory easier as it does not all need to be done at the same time. This is called **cycle counting**. This method of counting meets the requirements of the physical count if it is set up and done correctly.

## Errors in Inventory

For the exam, you need to be able to assess the way an error in one or more of the inventory amounts (beginning or ending inventory or purchases) will affect the balance of either ending inventory or cost of goods sold.

In questions about inventory errors, it is best to make two calculations. The first is what they did and the second is what they should have done. The difference between these two numbers will be the answer to the question relating to the effect of the error.

The two most common questions are what was the effect on ending inventory and what was the effect on cost of goods sold. You should use make both calculations for either type of question. The formulas you need are below.

If the question is about **cost of goods sold**, the formula is:

$$\begin{aligned} & \text{Beginning inventory} \\ + & \text{Purchases} \\ = & \text{Cost of goods available for sale} \\ - & \text{Ending inventory} \\ = & \text{Cost of goods sold} \end{aligned}$$

**Note:** You should also keep in mind that if COGS is overstated, then profits are understated. And conversely, if COGS is understated, then profits are overstated.

If the question is about **ending inventory**, the formula is.

$$\begin{aligned} & \text{Beginning inventory} \\ + & \text{Purchases} \\ = & \text{Cost of goods available for sale} \\ - & \text{Cost of goods sold} \\ = & \text{Ending inventory} \end{aligned}$$

**Example:** Medina Company has recently completed its physical inventory count and has adjusted the accounting records accordingly. As a result of this adjustment, on January 1, 20X9, the company's beginning inventory was \$150,000. During 20X9, Medina purchased \$525,000 of inventory and had an ending inventory of \$100,000.

However, it was later discovered that at the inventory count at the end of 20X8, the company failed to count \$30,000 of inventory. Medina also discovered that the purchases for 20X9 were overstated by \$18,000 as a result of some purchases being recorded twice. Finally, the ending inventory count at the end of 20X9 was overstated by \$15,000.

The best way to determine the total effect of these errors is to set up two COGS calculations – the first is what Medina did and the second is what it should have done.

	<u>What Medina DID</u>	<u>What Medina SHOULD HAVE done</u>
Beginning inventory	\$150,000	\$180,000
+ Purchases	525,000	507,000
– Ending inventory	<u>(100,000)</u>	<u>( 85,000)</u>
= Cost of goods sold	<u>\$575,000</u>	<u>\$602,000</u>

By using these two calculations, it is easy to see that the cost of goods sold was understated as a result of these errors. If the company had recorded everything correctly, the cost of goods sold would have been \$602,000 instead of the recorded \$575,000.

On the exam, we **strongly recommend** that you set up these two columns in order to answer a question about the effect of an error.

A **self-correcting error** is one that will correct itself in time, even if it is not discovered. The miscounting of inventory is a self-correcting error. While the error in ending inventory will have an effect on two balance sheets and two income statements, if inventory is correctly counted at the end of the next year, then there will be no further errors as a result of the miscounting.

Question 32: Holly Company's inventory is overstated at December 31 of this year. The result will be

- a) understated income this year.
- b) understated retained earnings this year.
- c) understated retained earnings next year.
- d) understated income next year.

(ICMA 2008)

Question 33: Which one of the following errors will result in the overstatement of net income?

- a) Overstatement of beginning inventory
- b) Overstatement of ending inventory
- c) Overstatement of goodwill amortization
- d) Overstatement of bad debt expense

(ICMA 2008)

**The following information is for the next four questions:** Addison Hardware began the month of November with 150 large brass switch plates on hand at a cost of \$4.00 each. These switch plates sell for \$7.00 each. The following schedule presents the sales and purchases of this item during the month of November.

Date of <u>Transaction</u>	Quantity <u>Received</u>	Unit <u>Cost</u>	Units <u>Sold</u>
November 5			100
November 7	200	\$4.20	
November 9			150
November 11	200	\$4.40	
November 17			220
November 22	250	\$4.80	
November 29			100

Question 34: If Addison uses FIFO inventory pricing, the value of the inventory on November 30 would be:

- a) \$936
- b) \$1,012
- c) \$1,046
- d) \$1,104

Question 35: If Addison uses weighted average periodic inventory pricing, the gross profit for November will be:

- a) \$1,482
- b) \$1,516
- c) \$1,528
- d) \$1,574

Question 36: If Addison uses periodic LIFO inventory pricing, the cost of goods sold for November will be:

- a) \$2,416
- b) \$2,442
- c) \$2,474
- d) \$2,584

Question 37: If Addison uses perpetual LIFO inventory pricing, the value of the inventory at November 30 will be:

- a) \$936
- b) \$1,012
- c) \$1,046
- d) \$1,076

(Source Unknown)

### Recognizing Permanent Declines through the Lower of Cost or Market (LCM)

Inventories are initially recorded at their cost. However, the value of inventory can decline over time. The inventory can become obsolete, it can be damaged, or because of market conditions, its market value can decline to a level below its cost.

Because inventory is an asset, it is important that it not be overvalued on the balance sheet. So if inventory's value declines, it should be written down to its lower market value. Therefore, at the end of each period a company must evaluate its inventory to make sure that its carrying amount is actually less than or equal to the amount of benefit that the company will receive from it in the future. This evaluation is the same process that is done with the calculation of the allowance for doubtful debts for accounts receivable and the impairment of fixed assets and intangible assets.

For inventory, the evaluation is done by comparing the cost of the inventory (what is recorded on the books) to the market value of the inventory. The value of the inventory on the balance sheet will then be adjusted to the lower of its cost or its market value. The term for this inventory valuation is **lower of cost or market**, or just **LCM**.

The **cost** of the inventory is simply its historical price as determined using one of the historical cost-based methods: FIFO, LIFO, average cost, or specific identification. However, the **market value** used in the calculation of the "lower of cost or market" is a little more involved. The word "market" in the term refers to the market in which the company **purchases** goods, not the market in which it sells them.

Thus the general rule for the "market value" is the price a reseller would have to pay to **replace** the inventory item or the cost to a manufacturer to **reproduce** the item.

As a general guide, replacement or reproduction cost is used for the market value because when the replacement or reproduction cost of an item declines, it usually means the selling price of the item will decline, as well. In a period of decreasing costs, the market value of an inventory item can decline simply because the cost to replace or reproduce it has decreased. Decreasing the value at which the item is carried in inventory allows the reseller to maintain a normal profit margin.

However, replacement or reproduction cost is not always the appropriate market value to use, and a declining cost does not always mean the selling cost will also decline. FASB ASC 330-10-35-4 says,

"In applying the rule, however, judgment must always be exercised and no loss shall be recognized unless the evidence indicates clearly that a loss has been sustained. There are therefore exceptions to such a standard. Replacement or reproduction prices would not be appropriate as a measure of utility when the estimated sales value, reduced by the costs of completion and disposal, is lower [than the replacement cost], in which case the realizable value so determined more appropriately measures utility."

Therefore, two other methods of valuing inventory are considered in addition to replacement cost. Of the three possible valuations, the market value used in the LCM valuation process is the **middle value** of the three.

The three possible valuations are as follows:

- **Ceiling**, also called the **Net Realizable Value**. The net realizable value is the maximum value used for the market value of the inventory. It is calculated as follows:

***Net Realizable Value or Ceiling = Selling Price minus the Cost to Complete and Dispose***

- **Current replacement cost**, or the cost to purchase the inventory now. The current replacement cost will usually given in any LCM problem.
- **Floor**, or the minimum value that will be used as the market value for the inventory. It is calculated as follows:

***Floor = Net Realizable Value (the Ceiling) minus a Normal Profit Amount***

Lower of cost or market is a conservative approach to inventory valuation

**Note:**

- "Market" is limited to an amount **not more than** net realizable value (the ceiling), and
- "Market" is limited to an amount **not less** than net realizable value less a normal profit margin (the floor).

Remember that in determining the lower of cost or market for an inventory item, you need to compare the cost of the inventory to the **middle of the three values** above (not the average of the three amounts).

Current replacement cost and other necessary amounts will be given to you in the problem and you simply need to use the numbers correctly in the formulas. The market value of the inventory will never be above the ceiling or below the floor.

If the market value used in the calculation of LCM is lower than the cost of the inventory, the difference (loss) must be written off. U.S. GAAP does not specify what account should be debited for the writedown. Two methods are acceptable:

- 1) Debit cost of goods sold.
- 2) Debit a loss account.

If cost of goods sold is debited, the loss is of course buried in the COGS account and cannot be seen or evaluated. If a loss account is used, the loss is shown separately from COGS on the income statement, and management can see how much it is. If the loss is presented separately, it should be presented on a line directly following the gross profit on sales line.

The credit for the writedown is usually made to an allowance account, a contra-asset account following Inventory in the general ledger, called Allowance to Reduce Inventory to Market. Thus the historical cost of the inventory is maintained in the inventory account while the valuation account is used to adjust the carrying value of the inventory to its lower market value. In addition, the use of an allowance account makes it possible to reconcile the subsidiary inventory records with the control account without changing costs of individual items on hand.

The journal entry for the writedown will be:

Dr	Inventory Loss or Cost of Goods Sold .....	X
	Cr Allowance to Reduce Inventory to Market .....	X

**Note:** The LCM Method can be applied to the entire inventory as one group, to groups or pools of inventory items, or to each item individually. **Applying it to each item individually will provide the lowest amount for ending inventory.** When each item is calculated separately, each item that has decreased in value will be written down. However, when groups, or pools, of inventory are used the decline in the value of one item may be offset by an increase in the value of another item.

Note that the valuation allowance needs to be eliminated when the inventory that was written down is sold. For example, if the historical cost of the inventory is \$100,000 and it has been written down by \$5,000 to a carrying value of \$95,000, if it is sold without any further cost being attributed to it, the amount debited to cost of goods sold should be \$95,000. The amount credited to Inventory should be \$100,000, and the difference is a debit of \$5,000 to the valuation allowance that eliminates the amount credited to the valuation allowance when the inventory was written down.

On the exam, any questions about LCM will generally be very straightforward and you will simply need to take the information that is given in the question and put it into the calculations needed to determine the market value of the inventory. In reality, most inventory will be carried at cost. However, on any exam questions, probably more than half of the inventory items must be written down to their market value.



**Example:** NT Manufacturing has work-in-process inventory with a sales value of \$110,000 and a cost of \$74,000. NT's cost to reproduce the inventory (replacement cost) is \$73,500. The estimated cost to complete and sell the work in process is \$10,000. NT's normal profit margin on sales is 25%.

Sales value of inventory	\$110,000
Less: Estimated cost to complete and dispose of inventory	<u>10,000</u>
Net realizable value	\$100,000
Less: Normal profit margin (25% of \$110,000 sales value)	<u>27,500</u>
Net realizable value less a normal profit margin	<u>\$72,500</u>

The ceiling to use in determining the market value is the net realizable value, or \$100,000. NT's cost to reproduce the inventory (replacement cost) is \$73,500. The floor to use in determining the market value is net realizable value minus a normal profit amount. NT's normal profit margin is 25%, so the floor is net realizable value (\$100,000) minus 25% of \$110,000 (\$27,500), which equals \$72,500.

So the three potential market values are \$100,000, \$73,500, and \$72,500. The one in the middle is \$73,500, so \$73,500 is the designated market value to use in determining lower of cost or market.

The historical cost is \$74,000 and the designated market value is \$73,500. The lower of the two amounts is \$73,500, so the inventory will need to be written down by \$500.

### LIFO and LCM

As mentioned previously, U.S. GAAP does not prescribe rules for applying the LIFO cost flow assumption in valuing inventory. Instead, IRS regulations provide the rules. **LCM may not be used with a LIFO cost flow assumption under IRS regulations.** As we mentioned earlier, if a company uses LIFO for tax purposes, the IRS requires it to also use LIFO for its financial reporting. However, the company is not required to use the **same** LIFO applications for its tax reporting and its financial reporting. A company may use different LIFO applications for tax reporting and financial reporting. The use of lower of cost or market with LIFO costing is an example of this flexibility.

Although IRS regulations do not permit the use of LCM with LIFO on the income tax return, LCM is applied with LIFO for financial reporting purposes. However, when prices are rising, the instances in which inventory is written down will be fewer under LIFO than under the other inventory cost flow assumptions because the historical cost of the inventory on the books will be lower. It will be more likely that cost will be lower than market value when LIFO is being used than when other cost flow assumptions are being used.

If inventory is written down to market value under LIFO, the application of LCM with LIFO internally but not for tax purposes will cause a temporary difference in the carrying value of the inventory between the financial statements and the income tax return.

## Investments

Firms hold various types of investments and they hold them for various purposes. Investments held may be equity securities or debt securities. The securities may be marketable (publicly traded on secondary markets) or not marketable (privately held). The securities may be held as an investment for unused funds until they are needed, or the securities may be held for the purpose of controlling another company.

Accounting for investments is accomplished by means of three different methods:

- 1) The **fair value** method, used for marketable debt and equity securities. The fair value method is used for debt securities and for certain equity securities. For equity securities, the fair value method is used generally when the investor owns less than 20 percent of the investee company's outstanding common stock and has little or no influence over the investee.
- 2) The **equity method**, used generally when an investor corporation owns less than 50 percent of the outstanding stock of the investee but has the ability to exercise significant influence over the operations of the investee company.
- 3) The **consolidation method**, used when the investor corporation owns more than 50% of the investee corporation's outstanding common stock. With greater than 50% of the outstanding common stock, the investor corporation has a controlling interest in the investee and the investee is a subsidiary of the investor. The investor consolidates the financial results of the investee with its own financial results and prepares consolidated financial statements. The consolidated financial statements are prepared as though the parent (the investor corporation) and the subsidiary (the investee) are a single economic entity.

### Fair Value Method for Investments in Marketable Debt and Equity Securities

For the purpose of the exam, marketable securities are shares of other companies that can be bought and sold on an open market, or the debt of another company that can be bought and sold on an open market.

### Debt Securities

Debt securities are classified in three different categories for accounting and presentation in the financial statements.

<b>Trading</b>	Securities bought and held principally for the purpose of selling them in the near term (generally within hours or days) with the objective of generating profits from short-term price changes.
<b>Held-to-Maturity</b>	Debt securities that are purchased with the intent to hold them to maturity.
<b>Available-for-Sale</b>	Securities not classified as either trading or held-to-maturity.

A company should classify a debt security as held-to-maturity only if it has both the positive intent and the ability to hold the securities to maturity. If the investor company anticipates that a sale of the security may be necessary before its maturity for any reason, the security should be classified as available-for-sale.

Debt securities are accounted for differently, depending upon how they are classified. For detailed information on the accounting for each type of debt security, please see the *Assumed Knowledge* book published by HOCK or any Intermediate Accounting textbook.

### Trading Debt Securities

Trading securities are accounted for at **fair value**, with unrealized holding gains and losses reported in net income. Market value adjustments are debited and credited to a fair value adjustment account for trading securities.

### Available for Sale Debt Securities

Available for sale securities are accounted for at **fair value**, with unrealized holding gains and losses reported in the equity section of the balance sheet as part of accumulated other comprehensive income. Premiums and discounts on available-for-sale debt securities are amortized, but the securities' values on the balance sheet are also adjusted to fair value at the end of each reporting period. Market value adjustments are debited and credited to a fair value adjustment account for available-for-sale securities.

### Held to Maturity Debt Securities

Debt securities classified as held to maturity are accounted for at **amortized cost**, not fair value. If management intends to hold the securities to their maturity date, the fair value (market value) of the securities is not relevant.

### Equity Securities

Equity securities are accounted for using the fair value method when the investor owns less than 20 percent of the investee company's outstanding common stock and has little or no influence over the investee. Equity securities under the fair value method are classified as either **trading securities** or **available-for-sale securities**. Equity securities cannot be classified as held-to-maturity since equity has not maturity date.

### Trading Equity Securities

Like debt securities, equity securities classified as trading securities are accounted for at fair value and the unrealized holding gain or loss is reported in net income. Market value adjustments are debited and credited to a fair value adjustment account for trading securities.

### Available-for-Sale Equity Securities

Available-for-sale equity securities are also accounted for at fair value. Like debt securities, the unrealized holding gain or loss is reported in equity as part of accumulated other comprehensive income. Market value adjustments are debited and credited to a fair value adjustment account for available-for-sale securities.

### Equity Method for Investments in Equity Securities

The equity method is used when the investor has **significant influence** over the investee. Owning between 20% and 50% of the outstanding voting stock usually indicates significant influence.

The investment is initially recorded at cost, but the investor corporation subsequently adjusts the balance in the investment account for changes in the investee's net assets. The investor's portion of the investee's earnings (or losses) periodically increases (or decreases) the investment's carrying amount on the balance sheet of the investor.

Since dividends paid decrease the net assets of the investee company, the investor company decreases its carrying amount for the investment by its proportionate share of dividends declared and paid. When a dividend is received, the investor debits cash and credits its investment in the investee (to reduce it) for the amount of the dividend.

If losses experienced by the investee company would cause the balance in the investor's investment account to become negative (because they exceed the amount of the investor's investment), the investor should stop using the equity method and begin using the fair value method in order to not recognize additional losses. However, if the investor company has obligations to provide financial support for the investee or if the investee is expected to return to profitability soon, then the investor should continue using the equity method and should recognize the additional losses.

Any profits or losses on transactions between the investor and the investee should be eliminated until the item is sold to an outside party. These profits or losses are eliminated by adjusting the investment and investment income accounts. Intercompany receivables and payables are not eliminated in the equity method

of accounting, but receivables and payables from companies that are accounted for using the equity method **should be disclosed separately**.

If the investor pays more for the shares than the proportionate net worth of the company, the difference between the amount paid and the proportionate net worth of the company is **equity method goodwill**.

However, equity method goodwill is not recognized as a separate line item asset. It is simply included in the investment account with all other assets.

**Note:** A notational reference to the amount of goodwill will probably be recorded, but it is not separately listed in the journal entry.

For detailed information on the application of the equity method to investments, please see the HOCK *Assumed Knowledge* book or any Intermediate Accounting textbook.

### The Fair Value Option

An investor may choose to report a specific security using the **fair value option**, with all gains and losses related to changes in its fair value reported on the income statement. The option is applied to a specific instrument on an instrument-by-instrument basis, and it is available only when the investor first purchases the financial asset. If an investor chooses the fair value option, it must apply that option consistently as long as it continues to own that security.

For example, an investor might purchase a debt security that it intends to hold until its maturity, but instead of accounting for it as a held-to-maturity security, the investor chooses to report that security using the fair value option. If the investor chooses the fair value option, it must continue reporting that security at its fair value until it sells the security. A valuation account is not used for that security because the fair value option applies to only that security. Instead, the security is carried in a separate account and the value of the security is increased or decreased directly, as appropriate.

Equity method investments may also be accounted for using the fair value option. If the fair value option is used, the investor does not report its proportionate share of the investee's income or loss, and dividends received by the investor are credited to dividend income and do not reduce the investments account.

### Consolidation Method for Investments in Equity Securities

Consolidated financial statements are usually required for a fair presentation when one of the companies in a group of companies directly or indirectly has a controlling financial interest in the other companies.<sup>20</sup>

There are two models for when a company must consolidate its investments:

- 1) **The voting-interest model:** When one corporation owns more than 50 percent of another corporation's outstanding common stock, it has a controlling interest in the other corporation. The other corporation is a subsidiary and the parent corporation must consolidate the financial statements of the subsidiary with its own financial statements. The parent company (the controlling company) will present the financial statements of the consolidated companies as if the two, or more, companies were a **single economic entity**.

**Note:** A majority-owned subsidiary should not be consolidated if **control does not rest with the majority owner**. For example, if the subsidiary is in legal reorganization or bankruptcy or if it operates under foreign restrictions, controls or other governmentally imposed uncertainties so strict that they cast significant doubt on the parent's ability to control the subsidiary, the parent may not have control.

<sup>20</sup> Per ASC 810-10-10-1.

- 2) **The risk-and-reward model:** Although control is normally demonstrated by ownership of more than 50 percent of the voting stock of a company, it is possible for there to be control with a smaller ownership percentage or no control with a higher percentage. If a company cannot determine control based on voting interest, it must use the risk-and-reward model. The risk-and-reward model states that if a company is involved substantially in the economics of another company, then consolidated financial statements must be prepared. The risk-and-reward model applies primarily to variable-interest entities, discussed further in this book in the topic of *Off-Balance Sheet Financing*.

At the end of each period, a consolidation worksheet is prepared. The balance sheets and income statements of the two companies are prepared in a columnar format and an additional column is created for adjusting/eliminating entries. The main exercise in the consolidation is the **elimination of intercompany transactions**. An event that gives rise to an asset for one company and a liability for the other company must be eliminated in order to prevent double counting of an event. Similarly, income statement events that are carried out between two consolidated companies need to be eliminated.

The main adjustments that need to be made are:

- The elimination of intercompany receivables and payables.
- The elimination of the effect of intercompany sales of inventory.
- The elimination of the effect of intercompany sales of fixed assets.

### Elimination of Intercompany Receivables and Payables

Because it is not possible for a company to owe money to itself, when the consolidated financial statements are prepared, any consolidated payables or receivables between the companies need to be eliminated.

If these items were not eliminated, the balance sheet would be “grossed” up because there would be an overstatement of payables as well as an overstatement of receivables. The amount of intercompany payables and receivables to eliminate should be equal to each other since if one of the consolidated parties has a related party receivable, another of the consolidated parties must have a related party payable.

### Elimination of the Effect of Intercompany Sales of Inventory

When a sale of inventory has taken place between companies that are consolidated, several adjustments need to take place.

- The inventory that was sold by one consolidated company to another consolidated company needs to be reported at the value that was recorded by the original purchaser of the inventory. When the inventory was sold to the related party, the buyer of the inventory recorded it at a higher amount than what the seller had recorded. Because we are trying to show all of these companies as if they were one company, we need to record the inventory at the value at which it was purchased when first bought by the “group.” So, if the inventory is still on the books of the company that purchased it, the inventory account must be written down.
- Any profit from the sale of the inventory recognized by the seller that remains in the company must be eliminated. When the seller sold the inventory to the related party buyer, the seller recognized some profit. However, if the buyer of the inventory has not yet sold the inventory to a third party, the profit that has been recognized by the seller needs to be eliminated. This is because the company cannot make a profit simply by selling inventory to itself.

If the buyer of the inventory has sold it to an unrelated third party, then the profit that the seller recognized does not need to be removed because the inventory is no longer in the group. The reported profit will be the sale price received by the company that ultimately sold the inventory to the unrelated third party minus the written-down value of the inventory.

**Elimination of the Effect of Intercompany Sales of Fixed Assets**

Similar to the adjustments required for the intercompany sale of inventory, adjustments must also be made if an intercompany sale of fixed assets has taken place. The adjustments are as follows:

- The carrying value of the asset needs to be adjusted to be what it would have been if the fixed asset had never been sold within the group. The historical cost on the balance sheet needs to be what the selling company paid for the asset and the accumulated depreciation needs to be what it would have been if it had not been sold. This adjustment must be made every year.
- The retained earnings of the selling company must be reduced in order to eliminate the gain that was recognized on the sale of the fixed asset.

**Elimination of the Parent's Investment Account**

Because the parent company owns shares of the subsidiary, it has an Investment account on its balance sheet that represents its investment in the subsidiary. Because the subsidiary's balance sheet is added to the parent's balance sheet in the process of the consolidation, the parent would be double counting that investment unless an adjustment is made. Essentially, the adjustment that is made eliminates the investment account on the parent's books against the equity accounts on the subsidiary's books. (You do not need to worry about the details of this elimination, other than to know that it happens.)

**Noncontrolling Interests**

Noncontrolling interests are the claims to the net assets of the subsidiary that are held by companies or individuals other than the parent company. They arise in a situation in which the parent does not own 100 percent of the subsidiary. If the parent owns 100% of the subsidiary, there are no noncontrolling interests.

In the consolidation, the balance sheet of the subsidiary is added to the balance sheet of the parent. However, if the parent owns only 90 percent of the subsidiary, for example, it should really only include 90 percent of the assets and liabilities of the subsidiary, because that is all it owns. However, the parent will include 100 percent of each of the individual assets and liabilities and then set up an account called Noncontrolling Interests that represents the claims on the subsidiary assets by the minority shareholders. In the consolidated balance sheet, this offsetting credit amount for the portion that does not belong to the parent company is shown as a separate caption in the stockholders' equity section. Accumulated other comprehensive income of the subsidiary is also apportioned between the parent and the noncontrolling interest and shown separately in the equity section. In the income statement, the noncontrolling interest in the income (loss) of the subsidiary is presented as a deduction from (addition to) consolidated net income.

**Other Eliminations**

Any other intercompany transactions also need to be eliminated. These intercompany transactions could be related to bonds, loans, notes payable or anything similar.

## Property, Plant and Equipment

Property, plant and equipment (also called fixed assets, or capital assets) are for many companies the largest asset on the balance sheet (especially for production companies with large production facilities). Therefore, it is an important that the company correctly value and account for fixed assets.

Fixed assets should be initially recorded in the accounting records at the amount paid for the **asset and all other costs that are necessary to get the asset ready for use**. This definition should seem familiar to you, as it is very similar to the definition of the costs that are included in the initial valuation of inventory.

You need to be familiar with what costs are to be included in the cost of the different classes of fixed assets. Below are some of the major classifications of assets and a listing of the items that are specific to that classification.

- For **buildings**, costs included are: the purchase price, costs of renovating or preparing the building, cost of permits, any taxes assumed by the purchaser, insurance paid during the construction of the building, materials, labor and overhead of construction.
- For **machinery and equipment**, costs included are: the cost of the machine, freight-in, handling, taxes, testing the machinery, and any other costs of getting the machinery ready for its intended use. For example, if the wall of the factory needs to be destroyed in order to get the machine into the factory, this cost, along with the cost of rebuilding the wall, will be included in the cost of the machinery because these were necessary to get the machine ready for its intended use.
- For **land**, costs included are: the purchase price including the amount of any mortgages on the property that are assumed by the purchaser, transaction costs, site preparation costs, the cost of purchasing an existing structure that will be destroyed, the costs of **razing (destroying and removing)** an existing building, the amount of any delinquent real estate taxes assumed by the purchaser, permanent improvements, and other costs necessary to prepare the land for its intended use. The costs of destroying an existing building are included in the cost of the land because until the old building is removed, the land is not ready for its intended use.

In addition, when a company constructs fixed assets for its own use, it will often need to obtain some amount of financing in order to pay for the costs of the construction. In some cases, it will be possible for the company to capitalize (include in the cost of the asset) some of the interest that it incurs from that external financing. Capitalization of interest is covered in the HOCK *Assumed Knowledge* book or any Intermediate Accounting textbook.

## Depreciation

A technical definition of depreciation is:

“The systematic and rational allocation of the costs of a fixed asset over its expected useful life.”

In other words, what depreciation does is match the expense (cost) of acquiring the asset with the revenues that it will generate over its useful life by spreading the recognition of expense of acquisition over the time period during which the asset will be useful (provide revenue) to the company. This is the concept of **matching**. Depreciation is a method of cost allocation. It is a purely mathematical process of dividing in some manner the cost of the asset between the periods in which it will be used.

Under U.S. GAAP, no attempt is made to report fixed assets at their fair value during their life because the value of the asset may fluctuate during its lifetime, and changes in fair value are difficult to measure objectively. In contrast, IFRS does permit revaluation of fixed assets to fair value if the revaluation is performed on a regular basis and the policy is applied consistently to all assets in the asset class.

## Accumulated Depreciation

Each year, depreciation is recorded by debiting an expense account (or an inventory account for manufacturing depreciation) and crediting an account called **Accumulated Depreciation**. Accumulated depreciation is a



valuation account. It is a contra-asset account which serves to decrease the carrying value of fixed assets to their book value. The book value is the gross amount minus the accumulated depreciation. The amount that was recorded in the fixed asset account at the time of acquisition will remain unchanged until disposal (unless there are capitalized subsequent expenditures).

The accumulated depreciation account is presented on the balance sheet as a reduction (or valuation) of the fixed assets account. In the example below, \$76,250 is the carrying value (or book value) of the fixed assets of the company.

Fixed assets	\$100,000	
Less: Accumulated depreciation	<u>(23,750)</u>	\$76,250

**Note:** The fixed asset account itself is not reduced as an asset is depreciated.

### Calculation of Depreciation

There are four methods of calculating the amount of depreciation to record that you need to be aware of for the exam. Each of these four methods is explained in detail below, but some general information is needed before depreciation can be calculated under any of the methods. These terms and their definitions are below.

- The **estimated useful life** is how long we expect the asset to be useful and it is the period of time over which we will recognize depreciation expense. At the end of its useful life the asset should have a book value equal to the expected salvage value. (The estimated useful life may also be called service life.)
- The **estimated salvage value** is the value we expect the asset to have at the end of its useful life. The book value of the asset may not be depreciated below the salvage value. Some companies have an accounting policy that the salvage value is always equal to \$0. (The estimated salvage value may also be called residual value.)
- The **depreciable amount or depreciable base** is the amount to be depreciated over the useful life of the asset. It is equal to the capitalized amount (this is the cost of the asset) minus the salvage value of the asset.

**Note:** Land is never depreciated because theoretically, the useful life of land is unlimited.

### Depreciation Methods

There are four main methods of calculating the annual depreciation expense. They are listed below with explanations about the way they are calculated. Please keep in mind that no matter which depreciation method is used, the journal entry on the previous page will be the same. These are simply different methods for calculating the value of x in the journal entry.

#### Straight-line Depreciation

Straight-line depreciation (STL) is the simplest method and results in an equal amount of depreciation expense charged to the income statement each period. It is calculated as follows:

**Depreciable Amount**

**Estimated Useful Life**

**Note:** Straight-line is the easiest depreciation method to calculate. As such, straight-line is the method of depreciation that will usually be used in questions that relate to depreciation but are not direct depreciation questions.

All the other depreciation methods result in greater amounts of depreciation being recorded in the early years of an asset's life and lesser amounts of depreciation being recorded in the latter years of an asset's life. All the other depreciation methods are called **accelerated depreciation methods**.



### Double Declining Balance

In double declining balance (DDB) method we use a rate that is **two times** (twice) the percentage that would be recognized under the straight-line method.

**Example:** if the useful life of the asset is 10 years, we will take a depreciation charge each year that is 20% of the book value at the beginning of each year. It is 20% because this is twice the 10% that would have been taken under straight-line.

The annual depreciation expense is calculated as follows:

$$\text{Double declining rate} \times \text{book value of the asset at the beginning of the year}$$

You need to remember that in this method the depreciation expense is calculated using the book value **at the beginning of the period**, not the original depreciable base.

Salvage value is not taken into account when calculating the annual depreciation charge. However, near the end of the asset's useful life, we need to pay attention to the salvage value to make certain that we do not depreciate the asset below its salvage value.

**Note:** Many companies will use DDB for the first few years of an asset's life and then switch to straight-line for the remaining years.

**Example:** Assume that a company buys an asset with a cost of \$100,000 and a salvage value of \$10,000. The estimated useful life is 4 years.

The depreciable amount is \$90,000 (calculated as the cost – the salvage value). This amount will be depreciated over the 4-year useful life. Given a 4-year useful life, the straight-line method would result in a depreciation expense equal to 25% of the depreciable amount. Therefore, under the double declining balance method, we will use 50% as the amount per year. However, instead of being 50% of the depreciable amount, we will take 50% of the **book value** at the beginning of each period. Using the beginning book value of each period, we must calculate the depreciation expense for Year 1 before calculating the depreciation expense for Year 2, and so on. The calculations are set out below.

**Year 1** - \$100,000 book value  $\times$  50% = **\$50,000** depreciation expense

**Year 2** - \$50,000 BV (\$100,000 – \$50,000 depreciation expense in Year 1)  $\times$  50% = **\$25,000**

**Year 3** - \$25,000 BV  $\times$  50% = **\$12,500**

**Year 4** - \$12,500 BV  $\times$  50% = \$6,250. **However**, if we were to record as depreciation the entire \$6,250, that would reduce the book value below the \$10,000 salvage value. Therefore, in Year 4, the depreciation expense is **only \$2,500**.

The total depreciation recorded during Years 1 through 4 will be 90,000, and at the end of 4 years, the book value of the asset will be its salvage value of \$10,000.

Under the double declining balance method we simply need to pay attention near the end of the useful life to make certain to not depreciate the asset's book value below its salvage value.

**Note:** With all the other methods of depreciation, we can calculate the depreciation expense for any year of the asset's life independent of the other, earlier years. However, in double declining balance, to calculate the depreciation expense for Year 2, for example, we need to first calculate the depreciation expense for Year 1 so that we know the book value to use in calculating the Year 2 depreciation. And before calculating Year 3, we need to calculate Years 1 and 2, and so forth.

In contrast, under the straight-line, sum-of-the-year's-digits and units of production methods (the last two are discussed next), we can calculate any subsequent year's depreciation amount without first calculating any of the preceding years' depreciation amounts.

### Sum-of-the-Years'-Digits

In the sum-of-the-years'-digits method, the amount of depreciation to be recorded for any given period is calculated using fractions based on the estimated useful life of the asset.

Under the sum-of-the-years'-digits method the depreciable base is multiplied by a fraction that is determined using the useful life of the asset. The denominator (bottom number) is a sum of all of its expected years of life. For example, if the asset has a useful life of 5 years, the denominator is the sum of the useful years ( $5 + 4 + 3 + 2 + 1 = 15$ ). The numerator will be the number of years remaining in its life, including the year for which depreciation is being calculated. Therefore, for a 5-year asset, the depreciation recorded in the first year is  $5/15$  of the depreciable base. In the second year the depreciation recorded will be  $4/15$  of the depreciable base, in the third year  $3/15$ , and so on.

If the number of years is too great to easily sum it, the sum can be calculated using the following formula, where  $n$  represents the total number of years of useful life for the asset:

$$\text{Sum of the Years' Digits} = \frac{n(n + 1)}{2}$$

For example, the sum of the years' digits to use for the denominator for an asset with a five-year useful life will be:

$$\text{Sum of the Years' Digits} = \frac{5(5 + 1)}{2} = \frac{5 \times 6}{2} = 15$$

The above is the same answer as you would get by doing the following summation:  $1 + 2 + 3 + 4 + 5 = 15$ .

**Example:** Assume that the company buys an asset with a cost of \$100,000 and a salvage value of \$10,000. The estimated useful life is 4 years.

The depreciable base is \$90,000 (calculated as the cost less the salvage value). This depreciable base will be depreciated over the 4-year useful life. With a useful life of 4 years, the sum of the year's digits is 10. Therefore, in Year 1, the company will record depreciation equal to  $4/10$  of the depreciable base, or \$36,000. The calculation for each of the 4 years is below:

Year 1 -	$\$90,000 \times 4/10 =$	\$ 36,000
Year 2 -	$\$90,000 \times 3/10 =$	\$ 27,000
Year 3 -	$\$90,000 \times 2/10 =$	\$ 18,000
Year 4 -	$\$90,000 \times 1/10 =$	<u>\$ 9,000</u>
<b>Total</b>		<b>\$ 90,000</b>

As you will notice, the total depreciation expense over the life of the asset is equal to the depreciable base that we calculated and the final book value equals the salvage value.

### Units of Production Method

Under the units of production method, we determine the number of units the asset will be able to produce over its useful life, and then the appropriate ratio of the depreciable amount is recognized as depreciation expense for each year of the asset's estimated useful life, based on the actual production of the asset during that period.

### Other Depreciation Methods

In addition to the four main methods listed above, you also need to be familiar with the terms used for the depreciation of natural resources, the depreciation of assets as a group and the method of depreciation used for tax purposes.

## Depletion

Depletion is the method of depreciation used for **natural resources**. It is calculated principally as the Units of Production Method of depreciation.

## Group Depreciation

Group depreciation is used to **depreciate a group of similar assets**. A weighted average useful life and a depreciation rate are applied to a group of assets. When an asset that is accounted for under group depreciation is disposed of, no gain or loss is recognized because this amount will be recognized in the depreciation expense charge.

Though we discuss disposals later, we will show the journal entry here because this is the main element of the group depreciation method. The journal entry to show this disposal will be as follows:

Dr	Cash .....	cash received
Dr	Accumulated depreciation .....	<b>plug figure</b>
Cr	Fixed assets .....	original cost

You will not need to calculate the depreciation expense under the group method, but you need to know what it is and that there is **no gain or loss on the disposal of an asset** that is depreciated in this manner.

**Note:** The term **composite depreciation** is used when dissimilar assets are grouped together and depreciated as a group. The process is the same as for group depreciation; it is just the name that is different.

## Depreciation Expense for Tax Purposes

In the United States and in most other countries, the tax laws specify the method of depreciation that should be used for tax purposes as well as the useful life that should be used for different classifications of assets. The depreciation methods described above are the methods prescribed by U.S. GAAP for use in the books of record. The tax depreciation method is used to calculate the amount of deductible depreciation expense the company has for tax purposes.

When the tax depreciation method is different from the method used for financial statement purposes, the company will have different book and tax depreciations. This is a temporary timing difference and a deferred tax issue. Deferred taxes are not covered here but are covered in the section relating to the accounting for income taxes.

## Depreciation in the Year of Acquisition and Disposal

Another accounting policy related to fixed assets that the company must determine is how much depreciation should be taken in the year of acquisition and how much depreciation should be taken in the year of disposal.

Our initial reaction would be that the company needs to take depreciation for the period of time that it actually owned the asset in each of those two years. While that is technically correct, it may be difficult to do when the company purchases and disposes of a large number of assets during the period.

In order to simplify the depreciation calculations, a company may adopt a policy under which it takes a certain amount of depreciation in the years of acquisition and disposal, no matter when it actually acquired the asset. The three main policies that a company might adopt are as follows:

- **Actual time of ownership** – the company recognizes depreciation expense for the actual time that it owned the asset in the year of acquisition and the year of disposal. This is the most accurate method, but also the most time consuming.
- **Full year in the year acquired and no depreciation in the year disposed** – the company takes a full year of depreciation in the year that the asset is acquired and has no depreciation in the year in which the asset is disposed of. This will be the case no matter when in the year the asset is acquired or disposed of.

- **Half-year convention** – the company recognizes six months of depreciation in the year of acquisition and six months of depreciation in the year of disposal, regardless of when during the years the acquisition and disposal take place. Because this method is the most involved it is looked at in more detail below.

**Note:** The second and third methods are not absolutely accurate, but if the company has enough transactions with fixed assets, they will come very close to approximating the depreciation that would have been recognized if each asset had been depreciated using its actual date of acquisition or disposal.

### The Half-Year Depreciation Convention

A common alternative method to the actual date calculation is the half-year convention, in which the company depreciates all assets as though they were acquired and disposed of on June 30. Using this convention makes the calculation easier in the year of acquisition and disposal than if the company calculated the actual number of days that it owned the asset.

**Note:** Almost all questions on the exam have assets purchased on January 1, and the half-year convention does not come into consideration. It is outlined here so that a question mentioning it would not surprise you.

If the half-year convention is used **with the straight-line method** we simply take one-half of the annual depreciation in the year of acquisition and one-half of the annual depreciation in the year of disposal.

If the half-year convention is used **with the double declining balance method** we need to be certain that we recognize only one-half of the calculated depreciation for the first year. After that, there are no adjustments needed for the half-year method since we use beginning book value in the calculation of depreciation expense until the final year in which the remaining depreciable amount will be depreciated.

However, if we use the half-year convention and the **sum-of-the-year's-digits** method, we will need to make an adjustment in every year. In the first year we will take only one-half of the amount of the first year's depreciation. In the second year we will take the second half of the first year's depreciation, plus one-half of the second year's depreciation. This means that in the second year the amount of depreciation (assuming a 5-year useful life) will be 4.5/15, and in the third year it will be 3.5/15; the first year would have been calculated at 2.5/15.

### Which Method of Depreciation is Best?

The method a company should use is the one that best matches revenue with expenses. The method of depreciation should **not** be selected on the basis of which method of depreciation will result in a desired net income amount, however.

If the revenues management expects to receive from the use of an asset will be constant over its useful life, straight-line depreciation should be used so that the costs will also be constant over the asset's useful life.

In contrast, if revenues from the use of the asset will be higher at the beginning of the asset's life, then an accelerated method of depreciation should be used. If an accelerated method of depreciation is used, expenses will be higher and net income and net assets will be lower in the early years of the asset's life than they would be if straight-line depreciation were used.

If revenues from the use of the asset will be lower at the beginning of the asset's life, the amount of depreciation recorded in the early years should be lower than the amount recorded in later years. Lower depreciation in the beginning of the asset's life can be achieved by using the units of production method. Expenses will be lower and net income and net assets will be higher in the early years of the asset's life than they would be if straight-line depreciation were used.

If the company can reliably estimate the timing of revenues to be received from the use of the asset, selecting the depreciation method that best matches the cost with the revenues will provide the most useful information to financial statement users for assessing future cash flows from the asset.

Question 38: On January 2, Rio Corp. bought machinery under a contract that required a down payment of \$10,000, plus 24 monthly payments of \$5,000 each, for total cash payments of \$130,000. The cash equivalent price of the machinery is \$110,000. The machinery has an estimated useful life of 10 years and an estimated salvage value of \$5,000. Rio uses straight-line depreciation. In its income statement for the year ended December 31, what amount should Rio report as depreciation expense for this machinery?

- a) \$10,500
- b) \$11,000
- c) \$12,500
- d) \$13,000

(Source Unknown)

Question 39: Sydney Co. purchased a machine that was installed and placed into service on January 1, 20X8, at a cost of \$480,000. Salvage value is estimated to be \$80,000, and the machine is being depreciated over 10 years using the double declining balance method. For the year ended December 31, 20X9, what amount of depreciation expense should Sydney report?

- a) \$96,000
- b) \$76,800
- c) \$64,000
- d) \$61,440

(Source Unknown)

### More Information

More information on depreciation is contained in the HOCK *Assumed Knowledge* book or in any Intermediate Accounting textbook.

### Impairment of Property, Plant and Equipment

Under U.S. GAAP, fixed assets are not written up to recognize any increase in the fair market value of the asset over time (note that this may be done under International Financial Reporting Standards).

However, a company must write its fixed assets down if the carrying value of the assets is greater than the **cash value of the estimated future cash flows** that will be created in the future by that asset. In this calculation we do not calculate the discounted cash value, but rather use the pure cash value.

**Note:** This is the same process that was done with accounts receivable through the allowance for doubtful debts and with inventory through the lower of cost or market calculation: trying to make certain that assets are not overvalued.

When considering whether a fixed asset should be written down, we must compare the **undiscounted sum of the future cash flows** expected to be generated through the use and eventual sale of the asset with the **book value** of the asset.

If the **asset's book value > future cash flows**, then the asset is considered to be **impaired**. An impaired asset is **written down to its fair value**. The amount by which the asset is written down is reported as a loss during that period.

The journal entry to record this will be as follows:

Dr	Impairment loss .....	X
	Cr    Accumulated depreciation .....	X

No entry is made to the Fixed Asset account. The credit to accumulated depreciation effectively reduces the book value of the asset.

After the impaired asset has been written down, the adjusted book value of the asset (the original cost in the Fixed Asset account less the balance attributed to the asset in the Accumulated Depreciation account) becomes its new cost basis, and future depreciation is recognized based on the new cost basis and the asset's remaining useful life.

If the **asset's book value < future cash flows**, the asset is not impaired and no adjustments need to be made.

**Note:** In summary, if the future cash flows from the asset are less than the assets carrying value, we write the asset down to its fair market value.

Question 40: In Joan Co.'s review of long-lived assets to be held and used, an asset with a cost of \$10,000 and accumulated depreciation of \$5,500 was determined to have a fair value of \$3,500. Determine the amount of impairment loss to be recognized if the expected future cash flow is (a) \$5,000 or (b) \$3,000.

- a)
- b)

(Source Unknown)

### Disposals of Fixed Assets

When a fixed asset is disposed of, the balances for that asset in both of the associated accounts (the fixed asset and accumulated depreciation accounts) must be written off the books, and a gain or loss is recognized for the difference between the fair value of what is received and the book value of the asset at the time of the disposal (cost – accumulated depreciation).

The journal entry to record the standard disposal for cash is as follows:

Dr	Cash.....	amount received
Dr	Accumulated depreciation.....	amount on books
Dr/Cr	Loss/Gain on disposal .....	balance
	Cr    Fixed assets.....	historical cost of asset

**Note:** The amount of the **gain or loss** is equal to the difference between the fair value of anything that was received for the asset and the asset's carrying value (i.e., book value). This calculation of gain or loss applies also to assets lost because of condemnation or to incidents that are covered under insurance such as theft or fire. The condemnation or insurance settlement is what was received for the asset, just as if the asset had been sold, and the gain or loss is the difference between that and the asset's book value.

Gains and losses are presented on the income statement below operating income as follows:

	Sales or service revenues
-	<u>Cost of goods sold (COGS)</u>
=	<b>Gross profit</b>
-	<u>Selling, general, and administrative expenses</u>
=	<b>Operating income</b>
+	Interest and dividend income
-	Interest expense
→ +/–	<u>Non-operating gains/(losses)</u>
=	<b>Income from continuing operations before income tax</b>
+/–	Gains/(losses) on operations of discontinued component (net of applicable taxes)
+/–	<u>Gains/(losses) on disposal of discontinued component (net of applicable taxes)</u>
	Income before extraordinary item
+/–	Extraordinary gain/(loss)
	<u>Less: Applicable income tax</u>
=	<b>Net Income</b>

## Intangible and Other Assets

Intangible assets are those assets of the company that are not physical or that cannot be touched. The accounting for intangibles is very similar to that for PPE. In this section we will look at the treatment of intangible assets as well as the following additional items or assets:

- Research and Development.
- Prepayments.
- Computer Software.

We have some of the same issues for intangibles that we had for PPE, and they are treated in approximately the same manner. These issues are:

- Initial recording of the item.
- Amortization of the cost of the item (for intangibles, amortization is the equivalent to depreciation of tangible assets).
- Adjusting the value of the asset to recognize any permanent decreases in its value.

## Amortization and Non-Amortization of Various Kinds of Intangibles

Some types of intangible assets are amortized and other types are not amortized. If an intangible asset has a finite life (a limited life), it is amortized. If it has an indefinite life, it is not amortized but is tested regularly for impairment and written down to its fair value if it is found to be impaired.

The common types of intangibles are:

A **patent** is the right of exclusive use granted by the U.S. Patent Office. Previously patents were valid for 17 years, but the length of time is now 20 years for all new patents. Patents are amortized over the shorter of the patent's legal life or the economic useful life of the patent. It is very possible that the economic useful life of the patent will be shorter than the legal life of the patent because of changing technologies.

For patents that are **purchased**, the patent should be recorded on the books at the purchase price. The purchase price is also the amount that should be amortized over the useful life of the patent.

For **internally developed patents**, the capitalized and amortized amount is generally limited to registration fees and legal fees for filing the patent. This accounting treatment is related to the accounting treatment for research and development. Research and development costs are generally expensed as incurred and thus they cannot be capitalized and amortized.



If a company **successfully defends a patent in court**, the cost of the legal defense is added to the intangible asset account and is amortized over the remaining useful life of the patent. However, if the company is **unsuccessful** in its defense of the patent, the remaining book value of the patent as well as the legal costs of the defense must be expensed immediately because the court ruling has essentially stated that the company has no patent or patent rights. If the company has no patent, the company has no asset.

**Franchises** are contractual agreements that allow a franchisee to operate a specific business using the name of the franchisor. The franchisee should capitalize the costs of acquiring the franchise and amortize them over the useful life of the franchise. A franchise with an indefinite life should be carried at cost and should not be amortized but should be tested at least annually for impairment.

**Note:** The franchisor (the seller of the franchise) should recognize franchise fees as revenue after having performed substantially all required services. If the fees will be received in the long term, the amount should be reported at their present value. This is covered again in the section on Revenue Recognition.

**Leasehold Improvements** are improvements that:

- Are made by a lessee to a building or property that the lessee is leasing.
- Cannot be removed by the lessee when the lease period is over.

An example of leasehold improvements would be the installation by the lessee of an air conditioning system in a leased building.

The cost of leasehold improvements should be amortized over the **shorter of the remaining lease term or the useful life of the improvements**.

When calculating the remaining term of the lease, any options to extend the term of the lease that are expected to be exercised should be included in the estimated lease term.

**Note: Furniture is not a normal leasehold improvement** because the lessee can remove the furniture when vacating the building. Therefore, furniture should be depreciated over the useful life of the furniture, regardless of the remaining length of the lease.

A **trademark** or **trade name** is a distinctive sign, word or symbol. Trademarks can be registered for 20 years and renewed for longer time periods. The costs that should be capitalized include legal and registration fees, design costs and any cost of successfully defending the name. The trademark should be amortized over its useful life, but the amortization period should not exceed 40 years. Trademarks are identified with the symbol ®.

A **copyright** is granted for intellectual property consisting of original works and is effective for the life of the author plus 70 years. Copyrights are not renewable.

Copyrights can be sold. As with patents, if a copyright is purchased, it is recorded at its purchase price. An internally generated copyright can be recorded at its registration costs only.

Copyrights are identified with the symbol ©.

Capitalized costs for copyrights are amortized over the useful life of the copyright if less than its legal life (the life of the creator plus 70 years). Any research and development costs that lead to a copyright must be expensed as they are incurred and thus are not capitalized or amortized.

Because it is difficult to assess the useful life of a copyright, companies usually write off amounts capitalized for copyrights over a fairly short period of time.

**Goodwill** is one of the most common examples of an intangible asset and is the one item that lacks specific identification. Goodwill is defined as the amount that a purchaser has paid for a company that is greater than the fair value of the net identifiable assets. Purchased goodwill must be reported as a **separate line item on the balance sheet**. Generally, other intangibles are combined and reported as one figure on the balance sheet.



Goodwill can be acquired or developed internally, but the only goodwill recognized in the accounting records is **purchased goodwill**. The amount of goodwill purchased is equal to the difference between the **purchase price paid for a business** and the **fair value of the net assets received**.

Internally generated goodwill is not recorded in the accounting records because it does not meet the definition of an asset. An asset is something that will benefit the company in the future, is owned currently by the company, and was acquired in a past transaction. Internally generated goodwill is not an asset because there was no past transaction in which it was acquired.

A company should record purchased goodwill on the books as an asset at the cost paid for it. It is considered to have an indefinite life, and therefore it should not be amortized. However, every year the company must assess its goodwill to determine if the goodwill has been impaired during the year.

**Note:** If the price paid for a business is **less than the value** of the net identifiable assets, the purchase is called a **bargain purchase**. The amount by which the purchase price is less than the value of the net identifiable assets should be recorded as an immediate gain by the purchaser. Because some companies might attempt to make an intentional error in measuring the net assets acquired in order to book such an immediate gain, the nature of the gain must be disclosed in the financial statements so users of the financial statements can evaluate it.

The costs of **developing goodwill or maintaining purchased goodwill** are expensed as they are incurred. Examples of these costs are training employees and hiring employees from the purchased company.

**Organizational costs** (also called **start-up costs**) must be expensed as they are incurred, and they may not be amortized. The costs of the original share issue are **not** organizational costs.

### Impairment of Intangible Assets

**Intangible assets with finite lives that are being amortized:** Similar to what is done for fixed assets, if at any time it is determined that an intangible asset with a finite life that is being amortized (such as a patent) is impaired or is no longer an asset (for example, a company loses a patent lawsuit), the asset should be written down to the amount of its expected future benefit. Any loss that is recorded must be written off in the period that the asset is determined to be impaired.

**Indefinite-life intangibles other than goodwill that are not being amortized:** Intangible assets other than goodwill that have an indefinite life should be tested for impairment at least annually. Impairment is determined by comparing the fair value of the intangible asset with the asset's carrying amount. If the asset's fair value is less than its carrying amount, the company must recognize an impairment loss by writing the asset down to its fair value.

**Goodwill:** Goodwill is not amortized but it must be tested for impairment every year or whenever changes in circumstances indicate that the carrying amount of the asset may not be recoverable. Since goodwill arises from the purchase of a business, impairment testing of the goodwill must be done in the context of the value of the business to which the goodwill is related. The impairment testing is done in two steps.

First step: The company compares the fair value of the net assets of the business with the carrying value of the business, including the goodwill related to the business. If the fair value of the net assets (including the goodwill) is less than the carrying amount of the net assets, then a second step is performed to determine possible impairment.

Second step: The second step involves determining the fair value of the goodwill and comparing that to the carrying amount of the goodwill.

- The fair value of the business less the net identifiable assets of the business **excluding the goodwill** is the implied value of the goodwill.
- The implied value of the goodwill is compared with the carrying amount of the goodwill. If the implied value of the goodwill is less than the carrying amount of the goodwill, the difference is written off as an impairment loss.

## Valuation of Liabilities

### Warranties

A warranty is a promise that a company makes to a buyer that if the product breaks during a specific time period, the company will pay to fix or replace the defective product. Warranties can be of two types:

- An **expense warranty** is a manufacturer's warranty given along with the sale of the product, without any additional payment being required from the customer.
- A **sales warranty** is an extended warranty that is sold separately from the product. Sales warranties may be offered by the manufacturer but also may be offered by either the reseller or by a third party.

### Expense Warranties

Expense warranties may be current liabilities or they may be partly current liabilities and partly long-term liabilities.

- If the term of the warranty extends only into the next accounting period, a current liability is recorded.
- If the term of the warranty extends beyond the next period, the estimated liability must be separated into a current portion and a long-term portion.

Because the company does not know exactly how many units will break or exactly how much it will cost to fix or replace those units, warranty expense under this type of warranty is an estimate.

At the end of each period the company must make a calculation of the amount of expected warranty claims that will be received in all future periods. This calculation can be based on a percentage of sales, or a cost per unit sold or some other manner. No matter which method is used for calculating the amount of the estimated warranty expense, the journal entry to record this liability and the expense for warranties is:

Dr    Warranty expense ..... as calculated  
       Cr    Estimated warranty liability ..... as calculated

*This entry will match the expense of the future warranty claims with revenues that were recognized from the sale of those items.*

When a warranty claim is received, the company will reduce the liability but will not recognize an expense because the expense was already recognized in the period when the sale was made (similar to the way bad debt expense is recognized). The entry to record actual expenditures is:

Dr    Estimated warranty liability ..... cash paid  
       Cr    Cash ..... cash paid

At the end of each year the company must evaluate the balance in the estimated warranty liability account to make certain that it is appropriate. If the amount is estimated to be too low, an additional expense and liability is recognized as with the first entry above. If it is determined that the liability is greater than it should be, a portion of the first entry is reversed in order to bring the warranty liability account down to its proper estimated value.

**Note:** If a warranty period expires, the company will need to remove any remaining Estimated Warranty Liability balance attributable to that warranty period by reversing any remaining amount of the first entry above.

You must be able to calculate **both** the **warranty expense** for a period and what the remaining **warranty liability** is.

The **warranty expense** is a simple percentage of sales (or other calculation) and does not take into account the amount of cash that has been paid on warranty claims.

The **warranty liability** is the total warranty expenses recognized in the past minus all payments that have been made on warranty claims.

Question 41: East Corp. manufactures stereo systems that carry a two-year warranty against defects. Based on past experience, warranty costs are estimated at 4% of sales for the warranty period. During 20X9, stereo system sales totaled \$3,000,000 and warranty costs of \$67,500 were incurred. In its income statement for the year ended December 31, 20X9, East should report warranty expense of:

- a) \$52,500
- b) \$60,000
- c) \$67,500
- d) \$120,000

(Source Unknown)

### Sales Warranties

When a warranty such as an extended warranty is sold separately from the product, the seller recognizes the sale of the warranty separately from the sale of the item covered by the warranty. Revenue on the sale of the extended warranty is deferred and is usually recognized on a straight-line basis over the life of the contract. If the extended warranty picks up after the manufacturer's warranty expires, recognition of the extended warranty revenue does not begin until after the manufacturer's warranty has expired.

Since the revenue for sales warranties is recognized throughout the term of the contract, **expenses incurred in fulfilling the contracts should be expensed as period costs when incurred**. However, **if** historical evidence indicates that costs under the contracts are incurred on some basis other than a straight-line basis, then **the revenue should be recognized over the contract period in proportion to the expected costs**.

Thus, **the liability for a sales warranty is the unearned revenue** on the balance sheet. Estimated future costs are **not** accrued as liabilities.

Example: An extended warranty is offered by a reseller with a product for an additional cost. The product costs \$5,000 and the extended warranty costs \$200. The reseller's entries are:

Dr	Cash .....	5,200
	Cr Sales .....	5,000
	Cr Unearned Warranty Revenue .....	200

The product is under warranty from the manufacturer for the first year, and the extended warranty covers years 2 through 5 (4 years). At the end of the 2<sup>nd</sup> year after the sale (i.e., after expiration of the manufacturer's warranty) and for each of the 3 following years, the selling company recognizes  $\frac{1}{4}$  of the unearned revenue on a straight-line basis. Entries at the end of Years 2, 3, 4 and 5 to recognize the revenue are:

Dr	Unearned Warranty Revenue .....	50
	Cr Warranty Revenue .....	50

Costs for repairing or replacing items covered by the sales warranty during years 2, 3, 4 and 5 are expensed as incurred.

## Off-Balance Sheet Financing

**Off-balance sheet financing** is any form of funding that avoids placing owners' equity, liabilities or assets on a firm's balance sheet. Off-balance sheet financing can be accomplished through the use of:

- Operating leases to finance acquisition of assets.
- Sale of receivables, also called factoring, in which the company can receive access to cash immediately in exchange for giving up the right to collect its receivables.
- Joint ventures, in which two or more "parent" companies agree to share capital, technology, human resources, risks and rewards in the formation of a new entity to be managed under their shared control.
- Non-consolidated subsidiaries, where a parent company's ownership is less than 50 percent. If the parent company does not have control over a subsidiary in which it has less than 50 percent ownership, it does not report the assets and liabilities of the subsidiary.
- In some cases, variable interest entities (formerly called special-purpose entities) can constitute a form of off-balance sheet financing. Variable interest entities are separate legal entities established to perform some narrowly-defined or temporary purpose, and their assets and liabilities may be carried on that entity's balance sheet instead of on the firm's balance sheet. However, variable interest entities are subject to special requirements to be used in determining whether their financial statements must be consolidated with those of another firm. If they do not qualify for non-consolidation, variable interest entities must be consolidated and thereby lose their off-balance sheet financing status.

## Operating Leases

Under current U.S. GAAP, a company that acquires a fixed asset by means of a lease must account for the asset and the lease under one of two methods: either as a capital lease or as an operating lease. The terms of the lease determine whether it is to be accounted for as a capital lease or as an operating lease.

If a lease is a capital lease, the acquired equipment is recorded on the balance sheet and depreciated as it would be if it were purchased, and the lease obligation is recorded on the balance sheet as a liability as it would be if it were a loan. If the lease is an operating lease, however, nothing is recorded on the balance sheet, and the periodic payments made under the terms of the lease are simply expensed as operating expenses.

Under current U.S. GAAP, if a lessee's management has discretion in the way it negotiates the terms of a lease, the lessee can effectively manipulate the accounting for the lease to keep it off the balance sheet by structuring the lease so it qualifies as an operating lease. When this occurs, the various capital structure ratios will be affected because both assets and liabilities will be lower than they would be if the equipment under lease were being reported as an asset and the lease obligation were being reported as a liability. A lessee may prefer to have its leases structured as operating leases in order to meet debt covenants that limit its use of debt or that require particular balance sheet ratios.

However, current U.S. GAAP is about to change. In 2005, the SEC issued a report containing important recommendations regarding the improvement of U.S. GAAP with respect to lease accounting. The report criticized current lease accounting on the basis that, for a lessee, "the accounting can flip between recording no assets and liabilities at lease inception to recording the entire leased asset and entire loan price with only a very small change in economics." As a result of this SEC report, the FASB and the IASB have jointly been reconsidering lease accounting. Several Exposure Drafts have been issued by the FASB. As this is being written, the FASB is making plans to re-deliberate issues raised by stakeholders in response to the latest Exposure Draft.

The basic approach of the new standard is that, for all leases within the scope of the proposed guidance,

- A lessee would recognize an asset representing its right to use the leased item for the lease term and a liability for its obligation to pay rentals.
- A lessor would recognize an asset representing its right to receive lease payments and **either** (1) a lease liability (a performance obligation) while continuing to recognize the underlying asset; or (2) derecognize the rights in the underlying asset and continue to recognize a residual asset representing its rights to the underlying asset at the end of the lease term.

If the final standard resembles the Exposure Draft, there will no longer be such a thing as an operating lease for a lessee. Leases will no longer be carried off balance sheet by lessees. All leases will be capitalized by lessees, so both an asset and a liability will appear on lessees' balance sheets.

The ICMA's policy is to test new standards only after they have been in effect for one year. You can monitor the progress of the new leasing standard until it is issued on the FASB's website by going to [www.fasb.org](http://www.fasb.org), then click on "Projects" at the top, then "Project Roster & Status." Under "Active Joint FASB/IASB Projects," click on "Leases." If you do not see "Leases" there, that means the new standard has been issued. Once the new standard has been issued, you should be able to locate information on the new standard by going back to the FASB's home page, then click on "Standards," then "Accounting Standards Updates."

### Factoring of Receivables

**Factoring** is another type of transfer of financial assets, except it usually involves trade receivables instead of loans. In essence what is happening in factoring is that a commercial finance company called a **factor** is making a loan to the seller of the receivables, and this loan is guaranteed (collateralized) by the receivables. However, the source of the factor's repayment is the collection of the receivables, not repayment from the seller of the receivables. The factor notifies the seller's customers to remit their payments directly to the factor. As the receivables are collected, the factor will get this money as a repayment of the loan.

Factoring comes under the same guidelines for accounting as a sale versus a borrowing as those given for variable interest entities. The transferred assets must be put out of reach of the transferor's creditors; the purchaser must have the right to pledge or exchange the transferred assets; and the transferor cannot maintain effective control over the transferred assets. If these guidelines are not met, the transaction must be accounted for as a loan, not a sale.

When the trade receivables are sold, they are derecognized, or removed from the seller's balance sheet. Funds are deposited into the seller's account with the factor. As long as the funds remain on deposit with the factor, they represent another form of deposit account. When the seller of the receivables withdraws some or all of the funds available in the factoring account, the withdrawn funds are reported as an increase to cash on the seller's balance sheet. If the seller of the receivables withdraws funds from its factoring account before the sold receivables have been collected by the factor, a form of off-balance sheet financing has taken place, and the seller must pay the factor interest on the funds withdrawn for the period until the receivables are collected by the factor.

### Joint Ventures

A joint venture is a type of partnership that has been organized for a limited purpose and usually for a limited period of time. Sometimes it is formed to fulfill a particularly large or risky contract that one contractor alone would not be able to perform. Two or more contractors will form a joint venture in order to bid on and obtain the contract. A separate set of accounting records is maintained for the joint venture. Each participating contractor reports a single line asset balance, "investment in and advances to joint ventures." In addition, each participating contractor records its share of the joint venture's income as a single line item on its income statement as in the equity method for investments. Footnote disclosure is required similar to disclosure for an equity method investment.

A joint venture may also be used to launch a new product or project. A company might use the joint venture to obtain off-balance sheet financing for the new project by contributing its know-how or other assets to the

joint venture while other partners contribute the money. The company may even exercise significant control over the venture's operations. The joint venture agreement might include the company purchasing the joint venture or the product and know-how at a future date. By using the vehicle of the joint venture instead of funding the project out of its own money, the company is able to accomplish its objectives while preserving its cash for other purposes.

### Non-Consolidated Subsidiaries

If a parent company does not have control over a subsidiary in which it has less than 50 percent ownership and therefore does not report the assets and liabilities of the subsidiary, the parent company reports its investment in the subsidiary as an investment on its balance sheet (assuming the parent is using the equity method to account for its investment).

However, the parent may ultimately be liable for the subsidiary's debt if the subsidiary gets into financial difficulty; and that liability may be considerable. Because the subsidiary's financial statements are not consolidated with those of the parent, users of the parent's financial statements may not be able to detect the liability.

### Variable-Interest Entities

**Background:** U.S. GAAP requires that when one company owns and has control over another company, the controlling company must prepare consolidated financial statements. The parent company (the controlling company) will present the financial statements of the consolidated companies as if the two, or more, companies were a single economic entity.

However, in the past there was no requirement for a company without a controlling ownership interest in another entity to consolidate that entity's financial statements with its own. A company would create a special-purpose entity (SPE), now called a **variable-interest entity (VIE)**, which is a legal entity created to fulfill narrow, specific or temporary objectives, with outside investors as the technical owners. It would transfer assets to the VIE or use it to finance a large project, thereby achieving a goal without putting the entire firm at risk. This led to some major abuses in which shareholders were deceived about the true financial condition of companies.

The most high-profile example of this deception was committed by Enron in the early 2000s. Enron created around 500 special-purpose entities, structuring them as limited partnerships in which its own senior executives served as the partners. In some cases, Enron had a very small ownership interest in the SPEs, and in other cases, none at all. These entities were used to borrow funds directly from outside lenders, with the debt collateralized by Enron stock owned by the senior executives and/or guaranteed by Enron. Enron then sold assets that it owned to the entities, and the funds borrowed by the entities were used to pay Enron for the assets purchased by the entities. Thus, money was borrowed and Enron received the proceeds of the loans but had no requirement to show the debt on its balance sheet. The activities of the entities could be kept separate from the activities of Enron, because Enron technically either did not own the entities or had a very minimal ownership interest in them.

**Current status:** Accounting guidelines have been changed since the early 2000s in order to significantly limit the use of variable-interest entities to keep assets and liabilities off a company's balance sheet. When variable-interest entities are used today, they are typically used for financial assets such as mortgage loans, commercial loans, credit card receivables, and so forth. A VIE is created to issue and sell securities that represent a beneficial interest in cash flows from a portfolio of financial assets. The sponsor transfers the portfolio of financial assets to the VIE. The proceeds the VIE receives from the sale of its securities are used to pay for the portfolio of loans or receivables transferred from the transferor and sponsor. Cash flows received by the VIE from dividends, interest, redemptions, principal repayments and realized gains on the financial assets are the source of the cash flows that are used to pay the investors who bought the securities. By its sale of its financial assets, the transferor is provided with fresh resources with which to fund new loans.

Variable interest entities are generally thinly capitalized entities that carry risks of economic losses and possibilities of economic gains that are beyond what the nominal owner(s), called "equity participants," could



absorb or be able to benefit from. Under the current guidelines, the **primary beneficiary** of a VIE is identified as the party that (1) has the right to direct the primary earnings activities or economic activities of the VIE and (2) has the obligation to absorb losses of the VIE and the right to receive benefits from the VIE. The **primary beneficiary is required to consolidate the VIE** as its subsidiary. Consolidation is required regardless of how much equity investment the primary beneficiary has in the VIE, even if that equity investment is none.

Furthermore, ongoing reassessment is required to determine whether an enterprise is the primary beneficiary of a variable interest entity and thus whether the variable interest entity should be consolidated or, if consolidated, should be deconsolidated.

New guidelines also limit when a financial asset that has been transferred to another entity can be **derecognized** (or removed from the balance sheet of the transferor). A transfer of financial assets may be in substance a loan to the transferor, and not a sale of assets at all. In order to be accounted for as a sale, transferred assets must be put out of reach of the transferor's creditors. Each holder of a beneficial interest in the financial assets must have the right to pledge or exchange the transferred assets. Furthermore, the transferor cannot maintain effective control over them. In order for the transferor to record the transfer as a sale, all of these conditions must be satisfied.

The above requirements for recognizing a sale of assets are not new. However, securitizations formerly enjoyed an exception, which was that sale accounting was permitted for certain mortgage securitizations even though the transferor had not surrendered control over the transferred financial assets. That is no longer permitted. Under the new guidelines, many types of transferred financial assets that previously could have been derecognized are no longer eligible for derecognition. If the transferor actually retains effective control over the transferred assets, the transfer must be accounted for as a secured borrowing.

The new guidelines were put into place because there was a perception in the marketplace and among regulators that the former reporting standards may have contributed to the deterioration of the credit markets that occurred in recent years as a result of the mortgage crisis.

### Why Companies Use Off-Balance Sheet Financing

Companies use off-balance sheet financing for various purposes. Sometimes, as with joint ventures, off balance sheet financing is the best or only way to make a project happen. When this is the case, the ability to keep the project going without depleting the company's other assets can mean more profits for the company and a better deal for investors. When the off-balance sheet financing involves selling trade receivables, as in factoring, the seller can benefit by not having to maintain its own staff to collect its receivables.

Another purpose of some forms of off-balance sheet financing is to decrease the reported debt on the company's balance sheet. Decreasing the reported debt can make the company's capital structure ratios appear more favorable. For example, its debt to equity and debt to total assets ratios will be lower, which may result in more favorable financing terms from lenders or help the company meet the covenants imposed on it by its lenders or by its bond indentures.<sup>21</sup>

However, when off-balance sheet financing is used to hide debt and deceive investors, creditors and regulatory authorities, it is not legitimate. That is the reason why recent changes have been made and continue to be made in accounting guidelines to limit or eliminate companies' ability to engage in certain types of off-balance sheet financing.

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<sup>21</sup> A bond indenture is the written agreement that describes the bond issuer's responsibility to the buyers of the bond or debenture issue. Among other things, the indenture sets forth the maturity date, the interest rate, and any covenants required. It is the formal agreement between a group of bondholders and the debtor as to the terms of the debt.

## Accounting for Income Taxes

### Deferred Taxes

Every company makes two separate calculations of income during a period. The first calculation is **book income**, or **financial income**, which is calculated using the rules of GAAP. Book income is the pre-tax financial income reported in the financial statements. Book income is the "correct" income because it is calculated according to GAAP.

The second calculation of income is made to calculate the company's **taxable income**. Taxable income is a tax accounting term and it is used for the amount upon which the company's income tax payable is computed. Taxable income is calculated by following the tax code of the IRS (the Internal Revenue Service, which is the tax body of the U.S. government). Taxable income is calculated by subtracting tax-deductible expenses from taxable revenue. Taxable income is calculated in order to determine how much money needs to be paid to the government in income taxes.

Financial income and taxable income differ for several reasons. Some examples are:

- For financial reporting, the full accrual method is used to report revenues, whereas for tax purposes a modified cash basis is used.
- For tax purposes, expense accrued for financial reporting for estimated liability for warranties is not allowed as a tax deduction until the amounts are paid.
- For tax purposes, expense accrued for financial reporting for estimated liability for pending litigation is not allowed as a tax deduction until the amounts are paid.
- By using accelerated depreciation methods for fixed assets for tax purposes, depreciation expense for tax purposes can be greater than depreciation expense for financial reporting purposes, leading to a lower taxable income in the early years of the assets' lives as compared with pretax financial income for the same years.

**Note:** The tax code of the U.S. is called the Internal Revenue Code (IRC).

Because different rules are used for the calculation of book income and taxable income, the income tax due according to book income and the income tax due according to taxable income will most certainly be different.

The tax due that is calculated using book income is the amount that we **want to pay** for taxes because it is based on the "correct" amount of income. Book income is based on accrual accounting.

The second calculation tells us the amount that we actually **need to pay** to the government, based on what the government thinks our income is using the Tax Code. The Tax Code calls for largely cash accounting. This second calculation is the amount of money that the government expects us to pay in taxes.

The fact that these two numbers are different is what gives rise to deferred taxes. Before we look into deferred taxes in greater detail, there is one item that we must keep in mind: as the accountants, we are correct in our calculations because we keep the company's books in accordance with GAAP. Therefore, the amount of taxes that we **want to pay** is "correct."

In a very simplified manner, the concept of deferred taxes can be described this way: if the amount that we **need to pay** is greater than the amount we **want to pay**, in essence we make a **prepayment** of taxes because we pay the larger amount that the taxing authorities require. This prepayment is recognized as an asset on our balance sheet.



For example, if the amount we want to pay (the “correct” amount based on book income) is \$90 but the amount we need to pay (the amount based on taxable income) is \$100, the taxes would be recorded as follows:

Dr	Income tax expense.....	90
Dr	Prepaid taxes (or deferred tax asset).....	10
Cr	Cash .....	100

On the other hand, if the amount that we need to pay is \$90 but the amount we want to pay is \$100, we have not paid all of the tax due according to book income and will have a tax payable as a result. This will be recorded on the balance sheet as a liability as follows:

Dr	Income tax expense.....	100
Cr	Cash .....	90
Cr	Taxes payable (or deferred tax liability) .....	10

The amount on the income statement as Income Tax Expense will always be the amount we **want to pay** according to U.S. GAAP. The difference between the amount we want to pay and the amount the government expects us to pay will be recorded on the balance sheet as either an asset or a liability. That difference is the deferred tax amount. Deferred taxes can be either assets or liabilities. Furthermore, they can be either current or non-current assets or liabilities.

The above description is a simplified way of describing deferred taxes, but it is in essence what is happening. Later we will look in more detail and see that there is more involved in the calculation.

**Note:** The treatment of differences between taxable and book income is covered in ASC 740. ASC 740-10-25-2b states “a deferred tax liability or asset shall be recognized for the estimated future tax effects attributable to temporary differences and carryforwards.” Thus the standard sets up an **assets and liabilities method** of recognizing the temporary timing differences (a difference between book and tax income that will reverse in the future) relating to taxes. The justification for this method is that timing differences actually lead to assets and liabilities for the company as a result of essentially prepaying taxes to the government or in deferring its taxes payable to a future period. These assets and liabilities need to be recognized in the financial statements.

The following table provides a few examples of the amounts calculated under GAAP, the IRC, and the deferred tax effect.

<b>Taxes we WANT TO pay Under GAAP</b>	<b>Taxes we HAVE TO pay Under IRC</b>	<b>Deferred Tax Status</b>
\$10,000	\$5,000	\$5,000 Liability
\$5,000	\$10,000	\$5,000 Asset
\$12,000	\$12,000	No Effect

These differences between the book income and the taxable income of a company are the result of the accountants’ using the accrual method of determining financial income and the IRS using what is essentially the cash method to determine taxable income.

Four potential events will cause a difference between financial income and taxable income, as follows:

- 1) An income item is recognized as taxable income before it is recognized in the accounting records as revenue, or
- 2) An expense item is deductible from taxable income before it is deducted in the accounting records as an expense, or
- 3) An income item is recognized in the accounting records as a revenue before it is recognized as taxable income on the tax return, or
- 4) An expense item is deducted in book income as an expense before it is deductible in taxable income.

**Example:** For tax purposes, revenues are recognized as taxable when they are received in cash. However, for book purposes revenue is recognized when it is earned.

For example, prepaid rent in the amount of \$5,000 is received at the end of December 20X1 for the month of January 20X2. The cash received will be taxable income for 20X1. However, in the lessor's accounting records, the rent will be revenue for 20X2 because 20X2 is the year in which the rental income is earned.

The lessor's tax rate is 35%, so the lessor's tax due for 20X1 is \$20,000 and that amount includes \$1,750, or 35% of the prepaid rent received during December for the month of January. The \$1,750 tax paid on the prepaid rent will actually be a prepayment of taxes and will be an asset to the lessor. The lessor debits deferred tax assets for \$1,750. The lessor debits income tax expense for 20X1 for \$18,250 (\$20,000 – \$1,750) because that is the amount due according to the lessor's books. The lessor pays the tax bill and credits cash for \$20,000.

The lessee moves out at the end of January and no other tenant is found for the remainder of the year. During January 20X2, the rent received during December 20X1 is earned and the \$5,000 becomes revenue on the lessor's income statement. However, no income tax will be due on the \$5,000 rental income because the tax was already paid on it for the 20X1 taxable year.

For 20X2, the lessor owes \$25,000 in income tax according to book income. That \$25,000 includes the \$1,750 in the deferred tax asset. However, the lessor pays only \$23,250 in income tax (\$25,000 – \$1,750) because that is what the lessor's tax return says it should pay. The lessor debits income tax expense for \$25,000 because that is the amount of tax it owes according to its book income. It pays the tax due and credits cash for \$23,250. The lessor also credits the deferred tax asset for \$1,750, reducing the deferred tax asset to zero. The deferred tax asset has reversed.

### Temporary Timing Differences

Deferred taxes arise because of what we call **temporary timing differences**. Temporary timing differences occur when an item is not recognized for both book and taxable income in the same period. In order for an item to be a temporary timing difference, the item must be recognized at some point in both book income and taxable income, though not in the same period.

**Note:** If an income or expense item is recognized only for book purposes or only for tax purposes, but not both, it is a **permanent difference**. Permanent differences do not give rise to deferred tax assets or liabilities. Permanent differences are discussed later.

The primary reason that we have these timing differences is that GAAP income is calculated on the accrual basis while taxable income is calculated on the cash basis.

We call these differences temporary because they will "reverse" over time. When an item is included in taxable income but not in book income this period, and in some future period the opposite will occur and the item will be included in book income but not taxable income, the item is a temporary timing difference that will reverse.

The reversal of these temporary differences over time means that over the life of a business there will be no difference between the total book income and the total taxable income.

Unfortunately, this statement is actually not true if a company also has permanent differences (discussed later), or if there are changes in the tax rate (also discussed later); but in principle it is true that the total book and taxable incomes of the company over time will be the same.

The situations that lead to temporary timing differences and the type of timing differences that arise are listed in the table. Descriptions and examples of each type of timing difference follow the table.

**Table of Temporary Differences and Their Results**

	Revenues and Gains	Expenses and Losses
Included in Taxable Income First	Deferred Tax Asset	Deferred Tax Liability
Included in Book Income First	Deferred Tax Liability	Deferred Tax Asset

**Note:** Discussed below are the temporary timing differences that lead to the deferred tax asset or liability. However, the amount of the temporary timing difference is not equal to the amount of the deferred tax asset or liability. After the determination of the amount of the temporary timing difference, the calculation of the deferred tax asset or liability requires an additional calculation. This calculation is looked at following the discussion of the different temporary timing differences.

### Deferred Tax Asset, or Prepaid Taxes

A deferred tax asset is created by an item that causes taxable income in the current period to be higher than book income in the current period. Because taxable income is higher, the company has had to pay more in taxes than its book income indicates it should have paid. Therefore, for book purposes this is a prepaid tax, or a deferred tax asset.

A deferred tax asset is created by either

- A **revenue that is taxable in the current period** but is not included in book income for the current period. For example, a deposit received for work to be performed in the future, rental income received in advance of the period covered, or subscription payments received in advance.
- Or an **expense that is included in book income** but is not deductible for tax purposes in the current period. For example, warranty expense debited to the income statement and credited to estimated warranty liabilities.

**Note:** When a deferred tax asset is created by an expense that is included in book income but not deducted from taxable income for the period, it is a **future deductible amount** because the item that gave rise to it will cause taxable income to be lower than book income at some point in the future.

### Deferred Tax Liability, or Taxes Payable

A deferred tax liability is created by an item that causes taxable income in the current period to be lower than book income in the current period. Because taxable income is lower, the company does not pay as much as its book income indicates it should pay in taxes in the current period. However, because the company knows that these temporary timing differences will reverse, it understands that the tax that was not paid this year will need to be paid in the future. Therefore, for book purposes this difference is recorded as a deferred tax liability.

A deferred tax liability is created by either:

- A **revenue that is included in book income** but not in taxable income in the current period. For example, interest income accrued monthly for book purposes on a debt security investment when the interest is received only semi-annually.
- Or an **expense that is deductible** for tax purposes but is not an expense for book purposes in the current period. For example, payment of an insurance premium in advance for insurance coverage during the coming year or the early years of an asset's life when accelerated depreciation is used for tax purposes while straight-line depreciation is used for book purposes.

**Note:** Another term that is used for deferred tax liabilities is **future taxable amount**, because the item that gave rise to it will cause taxable income to be higher than book income at some point in the future.

### Presentation on the Income Statement

With this as a background, we will first look at how income tax expense is presented on the income statement. There are in fact two **tax expense items** that can appear on the income statement. They are:

- 1) **Current Income Tax Expense** – the amount that is actually payable and due to the government (based on taxable income), and
- 2) **Deferred Income Tax Expense or Benefit** – the tax effect of timing differences between book income and taxable income. This deferred income tax item may be either a reduction to (a benefit) or an increase to (an expense) the current income tax expense. We will discuss the calculation of this amount in more detail later.

These two tax expense items taken together are equal to **Total Income Tax Expense** as calculated on the basis of financial income according to GAAP.

### Calculation of Current Income Tax Expense

The current income tax expense is the amount that is actually due to the government in taxes each year based on taxable income on the income tax return. Current income tax expense for each period is calculated as follows:

$$\text{Current Income Tax Expense} = \text{Taxable Income} \times \text{Income Tax Rate}$$

It is possible for a company to have a **taxable loss** rather than taxable income. If the company has a taxable loss, the amount of current income tax expense will be zero, which can lead to a tax refund for prior taxes paid and/or a deferred tax asset to be carried forward (covered later).

### Calculation of Deferred Income Tax Expense or Benefit

The calculation of the amount of deferred tax expense or benefit that is actually shown on the income statement is very straightforward. It is the **amount of change** of the total deferred tax asset and liability position of the company **during the period**.

The amount of change is calculated by comparing each deferred tax asset and liability account at year end with its balance at the beginning of the year. A company can have both deferred tax assets and deferred tax liabilities. The amount of deferred income tax expense or benefit on the income statement is the net of all the amounts of change in all the deferred tax accounts.

If we are in a better position (meaning a smaller deferred tax liability or a larger deferred tax asset) at the end of the year, a **deferred tax benefit** is shown on the income statement and the benefit amount is subtracted from current income tax expense payable to calculate total income tax expense on the income statement.

However, if we are in a worse position (meaning a smaller deferred tax asset or a larger deferred tax liability) at the end of the year, the amount of the change will be the **deferred tax expense** and the expense amount will be added to current income tax expense payable to calculate total income tax expense on the income statement.

Question 42: Which of the following represents a temporary difference that would be deductible on the tax return after it has been recognized in financial income?

- a) Subscription revenue received by a magazine publisher
- b) Warranty liabilities
- c) Payment of an insurance premium
- d) A deposit received from a customer by a contractor

(HOCK)

### Calculation of the Deferred Tax Asset or Liability

In general, the amount of the deferred tax asset or liability is the temporary timing difference amount multiplied by the enacted<sup>22</sup> tax rate that will be applicable when the difference reverses.

The calculation of the deferred tax asset or liability position at any point in time is a fairly simple and straightforward calculation when there is only one deferred tax item and when the item is created in one period. The process is more complicated when the item is created over a number of years and is then reversed over a number of years, as is the case with depreciation.

We will look first at the steps of the calculation of this amount when the item is created in one period, and then we will look at the calculation when the item is created over a period of time and reverses over more than one period in the future.

#### Single Period of Creation

When the temporary timing difference is created in a single period, the amount that will reverse in each future period is multiplied by the enacted tax rate for that period. The number of calculations depends on the number of periods over which the difference will reverse and the future tax rates in those periods.

#### Single Period of Reversal

When the temporary difference reverses in a single period (whether it is the next period or five years in the future), temporary difference is multiplied by the enacted tax rate for the period in which the item will reverse.

**Example:** MGB Co. made one sale on account in 20X5 for a total of \$100,000. The amount receivable will be received in 20X6. The enacted tax rate for 20X6 is 25%.

The amount of the temporary timing difference is \$100,000 and since it will reverse in 20X6, \$100,000 is multiplied by the 20X6 tax rate of 25%. MGB's deferred tax liability is \$25,000 for the tax that will be due on the \$100,000 cash to be collected in 20X6.

<sup>22</sup> "Enacted" is an important word in this sentence. "Enacted" means the tax rate has actually been codified into law and it will be effective during the future period. If a change in tax rates is simply being considered, the current tax rate should be used.

Question 43: On December 31, 20X8, HomeTheater Company received a \$20,000 deposit from a customer for a home theater installation to be completed in 20X9. HomeTheater included the \$20,000 in the revenue reported on its 20X8 tax return but it reported the receipt as a liability (unearned revenue) on its 20X8 financial statements. The enacted tax rates are 35% for 20X8 and 38% for 20X9. What amount of deferred tax asset or liability did HomeTheater report on its balance sheet for financial reporting purposes at the end of 20X8?

- a) \$7,000 deferred tax asset
- b) \$7,000 deferred tax liability
- c) \$7,600 deferred tax asset
- d) \$7,600 deferred tax liability

(HOCK)

### Multiple Periods of Reversal and a Constant Future Tax Rate

When the future tax rate is constant, the calculation is very simple, no matter how many periods the item reverses over. The amount of the temporary timing difference is multiplied by the future tax rate. When there is only one future tax rate, it does not matter in which period(s) the difference reverses as the tax rate is the same for all periods.

**Example:** MGB Co. made one sale on account in 20X5 for a total of \$100,000. The amount due by the customer will be received over two years, with \$50,000 to be received in 20X6 and \$50,000 to be received in 20X7. The enacted tax rate for all years is 25%.

The amount of the temporary timing difference is \$100,000. Since the tax rate is the same in all periods in which it will reverse, we again simply multiply this \$100,000 by the 25% enacted tax rate for 20X6 and 20X7. Again, MGB's deferred tax liability is \$25,000.

### Multiple Periods of Reversal and Changing Future Tax Rates

When the temporary timing difference is created in a single period but will reverse over a number of periods that have different tax rates, the calculation is fundamentally the same but is now a little bit more involved. Instead of making just one calculation as in the two previous examples, a separate calculation will need to be made for each year in which the temporary timing difference reverses. There are essentially two steps to this process:

- 1) Determine the amount of the temporary difference and how much of that difference will reverse in each future period.
- 2) Multiply the amount of the temporary timing difference that will reverse in each period by the **enacted tax rate** of that future period.

All of the calculations for each year in which the item reverses (the second step) are then added together for the deferred tax asset or liability.

**Note:** The enacted tax rate is the rate that has been enacted into law by the government as the rate for the future period in question. If no laws have been passed that change the tax rates in the future, we assume that the current tax rate will be the enacted rate for any future periods.

**Example:** MGB Co. made one sale on account in 20X5 for a total of \$100,000. The amount receivable from the customer will be received over two years, with \$50,000 received in 20X6 and \$50,000 received in 20X7. The enacted tax rate is 25% for 20X5, 30% for 20X6 and 35% for 20X7.

The amount of the temporary timing difference is \$100,000. Since this difference will reverse equally over two future periods, we will need to multiply the \$50,000 that will reverse in 20X6 by the 20X6 tax rate and the \$50,000 that will reverse in 20X7 by the 20X7 tax rate:

20X6:	$\$50,000 \times 0.30 =$	<u>\$15,000</u>
20X7:	$\$50,000 \times 0.35 =$	<u>\$17,500</u>
Total		<u>\$32,500</u>

MGB has a \$32,500 deferred tax liability at the end of 20X5.

### Multiple Periods of Creation and Reversal (Depreciation)

When the deferred tax item is created over more than one period and then eliminated over more than one period, the calculation becomes more involved, but it is still largely a mathematical operation. In an exam question, this will likely be an issue when depreciation is the temporary difference and when it is created and reverses over a number of periods. Depreciation is the best example of a difference that is created over a number of periods because of the length of the useful life of fixed assets.

A temporary difference is created whenever the company uses a different depreciation method for book purposes than is required for tax purposes. Tax depreciation is usually a very accelerated method.<sup>23</sup> If the depreciation used for taxes is more accelerated than the depreciation used for book purposes, in the early years of the asset's life, the tax depreciation expense will be larger than the book depreciation expense. This leads to taxable income that is lower than book income and thus creates a deferred tax liability. However, it is possible that the book depreciation expense will be larger than the tax depreciation expense in the early years of the asset, leading to a deferred tax asset.

**Note:** It is important to remember that the total amount of depreciation expense that will be recognized over the life of the asset will be the same, no matter which depreciation methods are used for book and tax purposes.

At the end of each period the company must calculate its deferred tax asset or liability position. Keep in mind that all of these calculations are **forward looking**. By "forward looking" we mean that the company is essentially standing at the balance sheet date and looking into the future periods and looking at the differences between book income and taxable income in the future periods only.

**Note:** In this discussion, we are using **depreciation** as the example. If the temporary difference that is created over a number of periods is caused by something else, the process is the same – only the terms will be different.

The steps for calculating the amount of deferred tax assets or liabilities with multiple periods are as follows. An example is on the following page.

- 1) Identify the **amount of the differences** in each future period. In a depreciation question, it may take a few periods for the entire difference to be created so there may be a few periods during which the deferred tax liability gets larger each period followed by its reversal over the last years of the asset's life.
- 2) Multiply the differences between tax and book depreciation in each future year by the enacted tax rate for that future year.

<sup>23</sup> For most assets, the method of tax depreciation required in the U.S. is a system called MACRS (Modified Accelerated Cost Recovery System), and it is essentially based on the double declining balance method of depreciation (or the 200% declining balance method—these are two names for the same thing).



- 3) Sum all of the calculations from Step 2. The sum is the deferred tax asset or liability at the end of the period. Remember, this is not the deferred tax expense or benefit, but the deferred tax asset or liability. The deferred tax expense or benefit is calculated by looking at the amount of change in the deferred tax asset or liability from the beginning of the year to the end of the year.

**Example:** On January 1, 20X5, JJJ Corp. buys a fixed asset for \$100,000 with no salvage value and a 5-year useful life. For book purposes the asset is depreciated on the straight-line basis, but for tax purposes the asset will be depreciated on the double-declining balance method for 3 years and then the straight-line method for the remaining 2 years.

Thus, the depreciation expense that will be recognized on the books and in the tax return for the life of the asset, as well as the enacted future tax rates, are as follows:

<u>Year</u>	<u>Book Depr.</u>	<u>Tax Depr.</u>	<u>Enacted Tax Rate</u>
20X5	\$20,000	\$40,000	25%
20X6	20,000	24,000	30%
20X7	20,000	14,400	30%
20X8	20,000	10,800	35%
20X9	20,000	10,800	40%

JJJ Corp. determines its deferred tax position at the end of 20X5 by multiplying each of the future differences by the tax rate for that year, as follows:

<u>Year</u>	<u>Difference</u>		<u>Enacted Tax Rate</u>		<u>Deferred Tax Amount</u>	
20X5	(\$20,000)	×	25%	=	(\$5,000)	(NOT USED in 'X5 Calculation)
20X6	(\$4,000)	×	30%	=	(\$1,200)	
20X7	5,600	×	30%	=	1,680	
20X8	9,200	×	35%	=	3,220	
20X9	9,200	×	40%	=	3,680	
<b>Total</b>	<b>\$20,000</b>				<b>\$7,380</b>	Deferred Tax Liability 20X5

As of the end of 20X5, the company has a deferred tax liability because the amount of the 20X5 depreciation expense was greater for tax purposes than for book purposes. The \$20,000 difference in income creates a liability that will reverse over the next four years at the enacted tax rates in effect in those years. Given that the company had no deferred tax assets or liabilities at the end of the year, the company has a deferred income tax liability of \$7,380. This is the amount of the change in the deferred tax position during the period (from a \$0 beginning balance to a \$7,380 liability at the end of the year).

Notice that the amount of future temporary differences (\$20,000) is equal to the amount of the past temporary differences (also \$20,000). This will always be the case. If we look ahead to 20X6, we will have the following calculation for deferred tax liability:

<u>Year</u>	<u>Difference</u>		<u>Enacted Tax Rate</u>		<u>Deferred Tax Amount</u>	
20X5	(\$20,000)	×	25%	=	(\$5,000)	(NOT USED in 'X6 Calculation)
20X6	(\$4,000)	×	30%	=	(\$1,200)	(NOT USED in 'X6 Calculation)
20X7	\$5,600	×	30%	=	\$1,680	
20X8	9,200	×	35%	=	3,220	
20X9	9,200	×	40%	=	3,680	
<b>Total</b>	<b>\$24,000</b>				<b>\$8,580</b>	Deferred Tax Liability 20X6

At the end of 20X6, the company will show a deferred tax liability of \$8,580. However, the amount of **deferred income tax expense will be only \$1,200**, the difference between the deferred tax liability at the beginning of the year and at the end of the year.

Notice again that the amount of future temporary differences (\$24,000) is equal to the amount of the past temporary differences (now \$24,000 because now both 20X6 and 20X5 are in the past).



Question 44: Skies Unlimited's 20X2 income statement had pretax financial income of \$38,000 in its first year of operations. Skies Unlimited invested in \$80,000 worth of assets during 20X2. Skies uses MACRS (Modified Accelerated Cost Recovery System) depreciation as required on its tax return and straight-line depreciation with no salvage value for financial reporting. The equipment has a five-year life and is being depreciated over six years since Skies uses the half-year convention. The differences between the book and tax deductions for depreciation over the six-year depreciation period of the assets acquired in 20X2 and the enacted tax rates for 20X2 through 20X7 are as follows:

<u>Year</u>	<u>Book over (under) tax</u>	<u>Tax rates</u>
20X2	\$(8,000)	30%
20X3	\$(9,600)	30%
20X4	\$ 640	35%
20X5	\$ 6,784	35%
20X6	\$ 6,784	35%
20X7	\$ 3,392	35%

There are no other temporary differences. Taxable income is expected in all future years. In Skies' December 20X2 balance sheet, the deferred income tax liability and the income taxes currently payable should be:

	<u>Deferred income tax liability</u>	<u>Income taxes currently payable</u>
a)	\$3,279	\$11,400
b)	\$3,279	\$8,400
c)	\$2,800	\$11,400
d)	\$2,800	\$8,400

(HOCK)

### Permanent Timing Differences

Permanent timing differences are items that cause differences between taxable income and book income but do not reverse over time.

Permanent differences **do not give rise to deferred tax assets or liabilities** because of the fact that by definition a permanent timing difference is something that will be recognized for either book or tax purposes, but not both.

In a question you will need to be able to identify what items in a list are permanent differences and do not give rise to a deferred tax asset or liability. The most commonly tested examples of permanent differences are probably municipal bond interest and the dividend received deduction. These items are looked at individually, and then other permanent differences are listed.

### Municipal Bond Interest

The most common example of a permanent difference is **municipal bond interest** (or any other tax exempt interest). A municipal bond, or muni-bond, is a bond that is issued by a local government. In the U.S., the federal government does not tax interest earned on municipal bonds. The fact that muni-bond interest is tax-free means that the income from the bond will be included in book income in the year it is earned, but it will **never** be included in taxable income because it is excluded from the definition of taxable.

### The Dividends-Received Deduction

The dividends-received deduction is applicable when a U.S. corporation owns shares in another qualifying U.S. corporation.<sup>24</sup> When the company owns less than 20% of the qualifying company, 70% of the dividends received are not taxable. If the company owns between 20 and 80% of the qualifying company, 80% of the dividends received are not taxable. If the company owns more than 80% of the qualifying company, 100% of the dividends received are not taxable. Because in many cases some of the dividend will still be taxable, the dividends-received deduction is only partially a permanent difference.

### Other Permanent Differences

Other examples of items that lead to permanent differences are:

- **Expenses incurred in the process of earning tax-exempt income** are not deductible for tax purposes, but will be deducted for book purposes.
- **Life insurance premiums paid by the corporation** are never deductible for tax purposes if the corporation is the beneficiary. However, for book purposes these are considered an expense.
- **Life insurance proceeds** received by the corporation are never taxable, but will be considered income on the income statement.
- **Expenses incurred as a result of the violation of a law** are not tax deductible.

### Treatment of Net Operating Losses

When a company has a taxable loss for a period, it can apply that loss to previously paid taxes and receive a refund and/or carry that loss forward to reduce future taxes payable.

The company **may** carry the net operating loss back 2 years and receive refunds for up to 100% of income taxes paid in those years. The loss must be applied to the earlier year first (2 years ago) and then to the most recent year. Any loss that remains after the 2-year carryback may be **carried forward** up to 20 years to offset future taxable income.

The company may elect to forgo the loss carryback and carry the entire loss forward, offsetting only future taxable income for up to 20 years. This would be done if the company had no taxable income for the previous two tax years; or tax planning strategies may dictate that it is better for the company not to carry the loss back, if the expected tax rate for the future will be higher.

Companies that have suffered past losses are often attractive takeover candidates because in some cases, an acquirer can use the acquired company's loss carrybacks and loss carryforwards to reduce its own income taxes.

### Treatment of Loss Carryback

In the U.S., if the company chooses to carry the loss back for 1 or 2 years, it can file a Corporation Application for Tentative Refund form (Form 1139) with the IRS to request a refund for the amount of previously paid income taxes covered by the loss. If no taxes were paid in the previous 2 years the company can carry the loss forward as a deferred tax asset for up to 20 years. The company will then use this carryforward to offset taxable income in a future period.

If the operating loss is carried back, the company determines the amount of the refund it is to receive, and the journal entry that the company will make to recognize this is as follows:

Dr	Income tax refund receivable .....	X
Cr	Income tax benefit from loss carryback.....	X

<sup>24</sup> The criteria for being a qualified corporation are outside the scope of this exam. For the exam you need to know how the dividend received deduction works, not what qualifies for the dividends received deduction.

The receivable is reported on the balance sheet as a current asset at year-end. The benefit from the loss carryback is reported on the income statement below the Operating Loss Before Income Taxes line as Benefit Due to Loss Carryback.

**Note:** The income tax benefit from this journal entry is recognized on the income statement in the period in which the loss occurred.

### Treatment of Loss Carryforward

If the loss will be carried forward to offset future taxable income, the company **needs to recognize a deferred tax asset in the period of the loss**. This deferred tax asset is for the amount of the loss that will be carried forward multiplied by the enacted tax rate when the loss is expected to be used. The deferred tax asset will be reported on the balance sheet and a "gain" (or reduction of tax expense) recognized on the income statement as Benefit Due to Loss Carryforward on a line below the Operating Loss Before Income Taxes line.

Though the deferred tax asset does not arise from a temporary timing difference, it is still treated as a deferred tax asset arising from a temporary timing difference. The FASB's position is that a loss carryforward is in substance the same as a deferred tax asset because both are tax-deductible amounts that will be available in future years.

Whether a deferred tax asset will be realized depends on whether the company expects to have enough taxable income during the carryforward period (20 years) to enable it to use the asset as a deduction from future taxes. If the company does not expect to be able to use the deferred tax asset to offset against future income taxes due, then the company should establish a valuation allowance for the deferred tax asset to reduce it to the amount the company expects to be able to utilize. The valuation allowance is established by debiting the account Benefit Due to Loss Carryforward and crediting a valuation account, a contra-asset account called Allowance to Reduce Deferred Tax Asset to Expected Realizable Value.

Tax planning strategies may dictate that it is better for the company to carry the loss forward instead of back, if the expected tax rate for the future will be higher.

### Owners' Equity

Owners' equity (or shareholders' equity) is the "balancing" element of the balance sheet. The assets represent what the company owns, the liabilities represent what the company owes to outside, third parties, and the owners' equity represents what the company owes to the owners of the company. It does not matter what the legal form of the business is and whether the company has one owner or thousands of owners, those owners will most likely have a claim on some of the assets of the company. This claim is represented by the owners' equity on the balance sheet.

More formally, owners' equity may be defined as the "residual interest in the assets of an entity after deducting its liabilities." Again, this represents the claims that the owners of the business have on the assets of the entity.

In essence, this means that if the owners liquidated the business, this is the amount that would be due to them after all of the assets are liquidated (converted to cash) and external debts are paid. (However, this statement is not actually correct since the assets are recorded at their historical value, but would be liquidated at the market value, and these two amounts are probably not the same. But at a very basic, conceptual level it is correct.)

The specific accounts that a company has in the owners' equity section of its balance sheet will depend upon the form of the company. A sole proprietorship will have one capital account for the owner, and a partnership will have a capital account for each partner.

**Note:** In the case of a corporation, owners' equity may also be called shareholders' equity. For this exam, the terms may be used interchangeably. Additionally, in this textbook the term "equity" may be used by itself without the word "owners'" or "shareholders" in front of it. This is done to make the book less cumbersome and read more easily.

## Corporate Shareholders' Equity

The balance sheet of a corporation includes two main classifications of owners' equity – contributed capital and retained earnings.

- 1) **Contributed capital** consists of the assets that are put into the company by the owners in return for their share of ownership of the company. The fair value of what is received in exchange for the shares (whether it is cash or another asset) will be recorded in two different equity accounts. (We will look at the journal later in more detail.) The two accounts and their descriptions are:
  - The **capital stock account** records the stated, or par, value of the shares that are sold. The company will have different capital stock accounts for each of the different types of share that it has issued.
  - The **additional-paid-in-capital (APIC) account** "holds" in it the value received for the shares that was above the stated, or par, value. As we will see later in the book, a company may have a number of different APIC accounts that are each used for either specific types of shares or specific transactions.
- 2) **Retained earnings** represent the **undistributed profits** of the company that have been reinvested in the company. These may also be called undistributed profits or undistributed earnings. We will use the term "retained earnings" in this book.

**Note:** Owners' equity also includes the accumulated balance of other comprehensive income. Other Comprehensive Income will be covered later.

Corporations may sell two general types of stock – **common stock** or **preferred stock**. In the following pages we look at the differences between these two types of stock and make some general statements about the characteristics of each. In reality, however, it is possible for a company to have some type or class of stock that does not fall exactly into one of these categories. The form and type of stock depends upon the way in which the company registered the stock and the characteristics that the company has given to it. As a result of this, the same company may have many different types (classes) of common stock and/or preferred stock.

## Common Stock

### Types of Common Stock

There are different types of common stock based on whether or not they have a "par" value. Par value is essentially the stated value of the stock that is printed on the share itself. However, the par value does not impact the selling price of the stock. The par value is assigned to the shares when they are registered and does not need to be any specific amount. In fact, par value is usually a small amount because of what it represents (covered below). When the shares are first issued and sold, the par value of the shares will be put into the Common Stock account, while the rest of the cash received goes into the Additional Paid-In Capital-Common Stock (APIC-CS) account.

There are two types of shares based on the existence of a par value:

- **Par (or Stated) Value** – Par value is the specified value printed on the share itself. Par value is the maximum amount of a shareholder's personal liability to the creditors of the company, because as long as the par value has been paid in to the corporation by the shareholders, the shareholders obtain the benefits of limited liability, and their potential for loss is limited to the amount they paid for their shares.

If stock is issued at **less** than its par value (at a discount), the owners may be called upon to pay in the amount of the discount to creditors if the corporation is liquidated and the creditors would have losses.

The par value of all shares issued and subscribed represents the legal or stated capital of a company. **Legal capital** is the portion of contributed capital that is required by statute to be retained in a business. This capital cannot be distributed as dividends. Because of this restriction on distribution, companies may choose to have a very low par value.

**Note:** In most states issuing shares below par value is not permitted.

- **No-Par Value** – For stock that does not have a par value, the legal capital is the total amount that is received when the shares are issued and the whole amount received is credited to the common stock account.

### Issuing Common Stock

When common shares are issued for cash, the standard journal entry for the issuance of common or preferred shares is:

Dr	Cash .....	cash received
	Cr	Common shares.....par value of shares issued
	Cr	Additional paid-in capital – common shares ..... balancing amount

This will be the basic journal entry for all of our share transactions, including preferred shares. In the case of preferred shares, we simply change the “Common Shares” account to “Preferred Shares.” It does not matter if the shares are sold at a price above or below the current market price for the shares. We will debit cash for the amount of cash received and divide this amount between common shares and APIC. **The only amount that will ever go into the common shares account is the par value of the stock.** Again, it does not matter if the sales price is above or below the fair market value of the shares. Issuances of shares for something other than cash are looked at below.

### Dividends

Dividends are the distribution of current profits and/or the retained earnings of the company to its owners. The declaration of cash or property dividends reduces total stockholders’ equity as a result of either the distribution of an asset (cash or other property) or the incurrence of a liability (dividends payable if the dividend is not immediately distributed).

There are a number of different forms in which dividends can be paid, the most common of which is a cash dividend. However, in all of the different types of dividends, essentially the same thing is happening in that some asset of the company is distributed to the shareholders. We look at each of the different types of dividends below.

**Note:** Companies often like to have a dividend that is constant over time because the payment of dividends is a better sign of stability within the company than earnings. This is because the payment of dividends represents a longer time frame than profit. Profit can be dramatically influenced by an individual or unusual event.

### Cash Dividends

A cash dividend is the most common form of dividend, and it has the most clear journal entries. Our discussion here focuses on both the journal entries and the dates for making the journal entries. The dates are not covered for the other types of dividends, but the principles that are outlined here are the same for other dividends as well.

One of the important areas relating to dividends is the dates related to dividends because they determine when journal entries are made. The three dates that you need to know related to the payment of a cash dividend are listed below.

- The **date of declaration** is the date when the board formally declares the dividend. It is on this date that the first journal entry is made. In this entry the retained earnings account is debited (this reduction represents that some of the available money has been distributed, reducing the amount that remains available to the shareholders) and a liability is set up.

This declaration of a dividend **reduces working capital** (working capital is calculated as current assets minus current liabilities) because the entry increases the current liabilities of the company. The amount in the journal entry is an estimated number. It is estimated because the exact number of shares to which the dividend will be paid is not yet known. The journal entry at the date of declaration is:

Dr	Retained earnings .....	X
	Cr Dividend payable .....	X

- The **date of record** is the date that is used to determine who actually will receive the dividend. Theoretically, no journal entry is made on this date because the entry on the date of declaration recognized the liability and the reduction in retained earnings. However, in reality, a company may need to make an entry on the date of record to correct the estimate that was made regarding the calculated amount of dividend that would be payable on the date of declaration.
- The **date of payment** is the date on which the dividend is paid. On this date the liability is eliminated and the cash account is decreased. The journal entry is:

Dr	Dividends Payable .....	X
	Cr Cash .....	X

### Liquidating Dividends

Liquidating dividends are those dividends that are a return **of** capital rather than a return **on** capital. These occur when the dividend distributed is greater than the amount in retained earnings. Any dividend paid in excess of the balance in retained earnings will be classified as a liquidating dividend because there are no profits to distribute.

In a liquidating dividend, the **APIC account is reduced** for the amount of the dividend that is liquidating. The journal entry for a dividend that is totally liquidating (meaning that there was no balance in the Retained Earnings account) would be:

Dr	APIC.....	amount of dividend
	Cr Cash .....	amount of dividend

It is possible that a dividend will be a partially liquidating dividend. This occurs when there is a balance in retained earnings, but the dividend declared is larger than that balance. In this case, the part of the dividend that is normal will be a reduction of retained earnings and the part that is liquidating will be a reduction of APIC. This is shown in the journal entry below.

Dr	Retained earnings .....	to zero
Dr	APIC.....	liquidating amount
	Cr Cash .....	amount of dividend

### Property Dividends

In a property dividend, the company is distributing an asset other than cash as the dividend. For example, the company may distribute inventory, fixed assets or shares in another company that it holds. The fact that a company declares a property dividend does not mean that the company does not have cash. A property dividend may be declared because the company is using its cash to finance an expansion or some other investment opportunity.

When a property dividend is declared, the reduction of (debit to) retained earnings is made at the fair value of the asset given up. The asset that is distributed as a dividend needs to be written off the books and this is done at its book value. Any difference between the carrying value of the asset and the fair value of the asset is recognized as a gain or loss on the disposal of the asset. This gain or loss is reported on the income statement as a part of **continuing operations**. The journal entry for a property dividend looks as follows:

Dr	Retained earnings.....	FMV of Asset
Dr	Loss on disposal of asset .....	Loss amount
Dr	Accumulated depreciation .....	Accumulated depreciation
Cr	Asset .....	Original Cost of Asset
Cr	Gain on disposal of asset.....	Gain amount

Essentially in a property dividend we are simply combining two events that could be represented by two journal entries.

The **first** of these events is the sale for cash of the assets to be distributed as the dividend. This would be accounted for as follows:

Dr	Cash .....	FMV of Asset
Dr	Loss on disposal of asset .....	Loss amount
Dr	Accumulated depreciation .....	Accumulated Depreciation
Cr	Asset .....	BV of Asset
Cr	Gain on disposal of asset.....	Gain amount

The **second** event is the distribution of the cash received in the sale of the asset. This would be recorded with the following journal entry:

Dr	Retained Earnings.....	Cash rec'd above
Cr	Cash .....	Cash rec'd above

**Note:** In total, as the result of the property dividend, the owners' equity of the company will decrease by the book value of the property distributed.

### Stock Dividends

A stock dividend occurs when the company distributes a dividend in the form of additional shares. The journal entries to record this will simply transfer some amount from Retained Earnings to the Common Stock and APIC accounts. This transfer out of Retained Earnings happens because, even though there is no actual distribution to the shareholders, some of the earnings of the company are now "owed" to the shareholders in the form of shares as a result of the shares issued in the stock dividend. Also, there are now shares outstanding, and this needs to be recognized. This is done by reducing Retained Earnings and increasing Common Stock and APIC. Remember that all of these accounts are equity accounts and represent the claims of the owners on the assets of the company.

The journal entry that is required is dependent upon the size of the dividend.



### Small Stock Dividend

If the stock dividend is a **small dividend** (meaning less than or exactly 25% of the total shares outstanding) the journal entry is based on the **fair value of the shares on the date of declaration**:

Dr	Retained earnings .....	fair value
Cr	Common shares – issuable as a dividend.....	par value
Cr	Additional paid-in capital – common shares .....	balancing amount

This journal entry is made on the date of declaration and there is **no adjustment for any change in the FMV** of the shares between the declaration date and the date of issuance.

**Note:** Even if the shares of stock will be distributed at a later date, there is **no dividend payable** set up. Rather, we will credit an account called **Common Shares – Issuable as a Dividend**, (as in the entry above) or some similar name. This means that there is **no liability** recorded on the balance sheet for a stock dividend.

### Large Stock Dividend

If the stock dividend is a **large dividend** (more than 25% of the total shares outstanding) the journal entry is based on the **par value of the shares**:

Dr	Retained earnings .....	par value
Cr	Common shares – issuable as a dividend.....	par value

Question 45: Griffey Corp. declared a 7% stock dividend on its 10,000 issued and outstanding shares of \$3 par value common stock, which had a fair value of \$6 per share before the stock dividend was declared. This stock dividend was distributed 90 days after the declaration date. By what amount did Griffey's current liabilities increase as a result of the stock dividend declaration?

- a) \$0
- b) \$700
- c) \$2,100
- d) \$4,200

(HOCK)

### Stock Splits

A stock split is initiated by a company as the result of the market price for a share becoming too high. As a result of this high share price, investors may be hesitant to buy the stock. In order to reduce the market price of the share, the company essentially cuts all of their shares into smaller pieces. As a result more shares are outstanding and each share is worth a lower market price. For example, in a 2-for-1 stock split, the owner of each share becomes the owner of two shares instead, but each share will have a market price that is half as big as it was before the split.

In a stock split, the **par value of each share of the stock is also reduced** in the same ratio.

When a company splits its stock no journal entries are made. A **memo entry** is made to demonstrate that there are now twice as many shares and the par value is lower, but the balance in all of the shareholders' equity accounts remains unchanged.

**Note:** There are also **reverse stock splits**. In this, the company in a sense consolidates its shares so that there are fewer shares, but each share is worth more. In a 1-for-2 reverse stock split, the owner of two shares becomes the owner of one share instead, but that one share will be worth twice as much as one share was worth before the reverse stock split.



## Preferred Stock

The most fundamental and important difference between preferred stock and common stock is that owners of **preferred shares do not have the right to vote**, whereas owners of common stock do have voting rights. However, preferred shares have three preferences over common stock that distinguish preferred shares from common shares. These items that make the preferred stock "preferred" are:

- Preference in the **claims to assets** in a liquidation, and
- Preference in the **payment of dividends**, and
- A difference in **how dividends are calculated**. Preferred shares usually have a higher par value than common shares, and the dividend that is paid is usually a percentage of that par (or stated) value. Therefore, the preferred dividend is more of a fixed amount than the common dividend because the common dividend is dependent on earnings and management decisions.

Because of these last two characteristics, preferred shares are **similar to bonds**. They are similar but there are also some very important differences between preferred shares and bonds. These differences are:

- If the company does not pay dividends on the preferred shares in a certain period, that does not constitute a default. While preferred shares have a preference in dividends over common shares, the receipt of dividends is not guaranteed for preferred shareholders
- Preferred shares do not have a face amount that needs to be repaid at a maturity date in the future the way bonds do.

## Types of Preferred Shares

There are many different types of preferred stock, but three of the most common that you should be familiar with are:

- **Redeemable Preferred Shares**– These preferred shares may be sold back to the company at a specified price at the **option of the shareholder**.
- **Callable Preferred Shares** – These shares can be called (or retired) at the **option of the corporation**. The journal entry is set out below. At this point you do not need to worry about the accounts used for the recognition of the "gain" or "loss." The recognition of gains and losses on share transactions is not done through the income statement, but is done entirely within Owners' Equity. This is discussed in much more detail as part of the treasury stock section.

Dr	Preferred stock.....	shares × par
Dr	Additional paid-in capital - preferred.....	(if any)
Dr	Retained earnings - <i>if loss</i> .....	"loss"
Cr	Cash .....	call price
Cr	Additional paid-in capital - preferred - <i>if gain</i> .....	"gain"

- **Convertible Preferred Shares** – These shares may be converted into common shares at the option of the shareholder. If they are converted, the newly issued common shares are recorded at the book value of the preferred shares that were converted. There is no gain or loss recorded on this transaction as the newly issued common shares replace the preferred shares on the books. The journal entry is:

Dr	Preferred stock.....	shares × par
Dr	Additional paid-in capital – preferred .....	(if any)
Cr	Common stock .....	shares × par
Cr	Additional paid-in capital - common .....	balancing figure

**Note:** There is **no gain or loss** (on the income statement or otherwise) on the conversion of preferred shares into common because no additional cash is paid and the ownership share of the shareholder has simply been transferred into common shares. Any gain or loss that happens as a result of differences in share prices will be recognized when the shares are eventually "retired."

### Preferred Dividends

There are two ways that dividends can be distributed to preferred shareholders. The type of dividend that a share receives is stated in the share itself.

**Note:** Under both types of dividends, preferred dividends are usually a percentage of the par value of the stock.

### Cumulative Preferred Dividends

A cumulative dividend is one that is **earned each year** by the preferred share. It is important to note that the word is "earned." This does not mean that company actually distributes the dividend each period, just that the shareholder has earned the dividend and has a right to receive that dividend in the future.

For those years when the dividend is not paid, the amount that is not paid is "**in arrears**." This term means that the company is behind schedule in respect to preferred, cumulative dividends and has missed at least one payment of dividends that should have been made. **These dividends in arrears must be paid in full at some point in the future before common dividends can be paid.**

Preferred cumulative shares are very similar to debt (bonds) because there is a fixed interest payment that cannot be avoided. The difference is that the dividend payment can be delayed more easily than bond interest. Also, the nonpayment of the preferred dividend does not put the company in default, as would the nonpayment of bond interest.

**A journal entry for cumulative dividends is made only when the dividend is actually declared.** No liability is recorded on the books until the dividend is actually declared. Once the dividend is declared, the journal entries are the same as they were for a cash dividend described earlier.

Any cumulative dividends in arrears on cumulative preferred stock must be paid in full before any common dividends can be paid. Though this is in some ways a liability, it will not be recognized in the financial statements as a liability because the company has not declared the preferred dividend. It seems that this is a liability, but in reality the company never has to pay the dividends in arrears. The requirement is that any dividends in arrears must be paid before common dividends are paid. If the company does not pay the cumulative dividends, it is not a problem as long as the company never wants to pay common dividends.

Dividends in arrears are **not recorded as a liability, but are disclosed in a note to the financial statements**. This disclosure is necessary so that a prospective buyer of the shares can know whether or not the company will be able to pay dividends in the future. If there are large cumulative dividends in arrears it will indicate that the company will not be able to pay common dividends until those preferred dividends in arrears are paid.

### Noncumulative Preferred Dividends

Dividends that are noncumulative (the second type of dividends) are "lost" if they are not declared for any given year. These are simply dividends that are payable at the discretion of the company. The journal entries for these dividends are the same as for common dividends.

**Exam Tip:** If an exam question does not specify whether preferred shares are cumulative or noncumulative, assume they are noncumulative.

### Participating Preferred Shares

Preferred shares may also participate in the common dividend if they are set up that way in the registration of the shares. **Fully participating preferred shares** are treated as if they were common shares and will receive the entire common dividend, while **partially participating shares** have some limit on the amount that can be received.

### Share Issuance Costs

In the process of issuing shares, the issuing company incurs costs. These costs may include legal, accounting and marketing or promotional costs. Share issuance costs are accounted for as a **reduction of the cash** received from the issuance of the shares and a **reduction of APIC**. In essence, the journal entry to record the costs related to the issuance of shares is:

Dr	APIC .....	amount paid
	Cr	Cash .....
		amount paid

**Note:** Note that the treatment of share issuance costs is different from the treatment of bond issue costs. Bond issue costs are carried on the balance sheet and amortized over the life of the bond. This can be done for bonds because the bond has a definite life. Since shares do not have a maturity date, it is not possible to amortize share issuance costs over the life of the shares because the length of the life of the shares is indefinite.

### Retained Earnings

The retained earnings account is the final destination for all profit and loss accounts. Retained earnings represents the accumulated undistributed income of the corporation from its inception.

In the year-end close, net income for the year is moved to retained earnings. Retained earnings is decreased when dividends are paid. Retained earnings is a permanent balance sheet account, so the balance in it accumulates from year to year.

Retained earnings is calculated as all of the profits of the company since it started minus any dividends declared and amounts transferred into paid-in-capital accounts.

All retained earnings start out classified as **unappropriated retained earnings**. The term “unappropriated” simply means that the dividends are available to be distributed to shareholders in the form of dividends. Occasionally, however, a company does not want to distribute its retained earnings and its intention to not distribute all or a portion of its retained earnings can be communicated to the shareholders (and potential shareholders) through the process of **appropriating retained earnings**.

Appropriation of retained earnings is accomplished by means of a resolution approved by the corporation’s board of directors. The appropriation of a portion or all of retained earnings informs the readers of the financial statements that the appropriated retained earnings are not available for distribution as dividends.

Retained earnings are appropriated in the financial statements by debiting the retained earnings account and crediting the appropriated retained earnings account. A company may have several separate appropriated retained earnings accounts if its retained earnings are being reserved for multiple purposes at the same time.

A company may decide to appropriate retained earnings for several reasons. Among them are:

- Creating a reserve to build a plant.
- Acquisitions.
- Debt reduction.
- Meeting the requirements of a bond or a restriction on the payment of dividends imposed by a loan covenant.
- Providing for research and development or new product development.
- Marketing campaigns.
- As a reserve against an expected loss.
- Simply providing for the future.

The board of directors can de-appropriate the retained earnings at any time. Once the purpose for which the retained earnings have been reserved has been fulfilled, the appropriation is cancelled and the segregated retained earnings are returned to the main retained earnings account.

Appropriated retained earnings may also be referred to as a "reserve" for something such as bond retirement or as "restricted retained earnings."

You need to remember, however, that the purpose and effect of appropriating retained earnings is to let shareholders know that the appropriated retained earnings will not be distributed as a dividend.

## Treasury Stock

Treasury stock is shares of a company that have been sold to other parties and then reacquired by the company. The company has become a holder of its own shares and may either retire these shares or hold them for sale at a later time.

A company may purchase treasury shares for a number of reasons. Among them are:

- To temporarily provide a market for its shares.
- To reconsolidate ownership.
- As an investment if the company thinks its shares are undervalued.
- To use the shares for a stock dividend, to re-sell them, or to reissue them as share-based payment.

**Note:** Treasury shares **do not receive dividends, do not get to vote** and are **not classified as outstanding**. Treasury shares are issued, but are not outstanding. If they are later resold or reissued, those shares will again become issued and outstanding.

When a company purchases treasury stock, it recognizes the treasury stock in its financial statements by debiting the Treasury Stock account. The Treasury Stock account is not an asset, nor is it a liability or equity. Treasury Stock is a type of account all by itself. It is usually shown on the balance sheet in Owners' Equity as a reduction of owners' equity, so it is a contra-equity account.

## Classification of Shares

On the balance sheet (and in more detail in the notes to the financial statements), shares will be disclosed by giving the number of shares authorized, issued and outstanding. You must be familiar with these different terms and what they include.

### Authorized Shares

The number of **authorized shares** is the total number of shares that the company has registered. The number of authorized shares is the maximum number that can be sold. Authorized shares can be issued or unissued, or outstanding or not outstanding. The number of authorized shares **is affected by a stock split, but not affected by a stock dividend or treasury share transaction**.

### Issued Shares

The number of **issued shares** is the number of shares that have been sold to an outside party at any point in the past. Issued shares may currently be held either by others or by the company itself as treasury shares. The number of issued shares **is affected by both stock splits and stock dividends**. The number of issued shares is **not affected by treasury share transactions**.

### Outstanding Shares

The number of **outstanding shares** is the number of shares that are **currently owned by other parties**. Outstanding shares will be equal to the number of issued shares minus the number of shares held as treasury

shares by the company itself. The number of shares outstanding is **affected by both stock splits and stock dividends as well as by treasury share transactions.**

The following table summarizes which of the classifications of shares are affected by stock splits, stock dividends and treasury shares.

	Stock Split	Stock Dividend	Treasury Shares
Authorized	Yes	No	No
Issued	Yes	Yes	No
Outstanding	Yes	Yes	Yes

Question 46: The following information was abstracted from the accounts of the Moore Corp. at year-end:

Total income since incorporation	\$840,000
Total cash dividends paid	260,000
Fair value of a 20% stock dividend distributed	60,000
Excess of proceeds over cost of treasury stock sold	140,000

What should be the current balance of retained earnings?

- a) \$520,000
- b) \$580,000
- c) \$610,000
- d) \$660,000

(Source Unknown)

## Comprehensive Income

U.S. GAAP requires the disclosure of **comprehensive income** in the financial statements as well as a reconciliation between net income and comprehensive income.

Comprehensive income is the calculation of income that includes **all transactions of the company except for those transactions that are made with the owners of the company.**

Comprehensive income includes all of the reported net income of a company. Net income flows to Stockholders' Equity as retained earnings. Thus, net income is part of comprehensive income and part of Stockholders' Equity as well.

Comprehensive income also includes some other items that are not included on the income statement but instead flow directly to Stockholders' Equity. These items are recorded on a line called **accumulated other comprehensive income**. The word "other" means these items are comprehensive income **other than** net income items. Net income is **also** comprehensive income, but the items in accumulated other comprehensive income must be **added to** net income in order to present all of the comprehensive income.

Accumulated other comprehensive income is a component of Stockholders' Equity. The transactions in the accumulated other comprehensive income account do not affect the income statement, but they do affect Stockholders' Equity. Since accumulated other comprehensive income is a balance sheet account, it is a permanent account, which means it is not closed out at the end of each fiscal year. Therefore, the balance in it continues to accumulate. Hence, it is called **accumulated** other comprehensive income. In practice, it is usually referred to simply as accumulated other comprehensive income, but the account could also carry a balance representing an accumulated loss. In that case, it would be presented on the balance sheet in the Equity section as **accumulated other comprehensive loss**.

The reconciliation between net income and comprehensive income is quite straightforward because there are four items that are reported in comprehensive income that are not part of net income. These four items are listed below.

A Statement of Comprehensive Income is required. Presentation of the Statement is covered in this volume in the topic *Statement of Comprehensive Income*.

Items that should be treated as **other comprehensive income** are expressly stated in the standards. There are currently four items that are included in this group, which are (and you must memorize this):

- Foreign currency translation adjustments,
- Gains or losses and prior service costs or credits related to a defined benefit pension plan that have not been recognized as components of net periodic benefit cost,
- Unrealized holding gains or losses on available-for-sale securities, and
- The effective portion of the gain or loss on a derivative designated as a cash flow hedge.

These four items may be shown as net of tax, or not shown net of tax. However, if they are not shown net of tax, income tax related to other comprehensive income must be disclosed on a separate line in the Statement of Comprehensive Income.

A company must report the accumulated balance of the items of other comprehensive income on the balance sheet as an **element of owners' equity**. It should be reported separately from the other owners' equity accounts.

**Note:** It is very possible for a company to have none of these items, and therefore this will not be an issue. In this case, the income statement simply becomes the Statement of Comprehensive Income. For the exam, you must be able to identify the items that are included as Other Comprehensive Income items.

Question 47: Which one of the following would be **excluded** from Other Comprehensive Income reported for the current year?

- a) Foreign currency translation adjustments.
- b) Foreign currency remeasurement gains or losses.
- c) Unrealized holding gains or losses on available-for-sale securities.
- d) Additional pension liability in excess of unrecognized prior service cost.

(ICMA 2008)

## Revenue Recognition

**Note:** On May 28, 2014, the FASB issued Accounting Standards Update No. 2014-09, *Revenue from Contracts with Customers* (Topic 606).

For a public entity, the amendments are effective for annual reporting periods beginning after December 15, 2016, including interim periods within that reporting period (that is, for a calendar year-end public entity, the changes take effect beginning January 1, 2017). Early application is not permitted.

The CMA exams test new standards after they have been in effect for one year, so that means candidates will be responsible for the new revenue standard after January 1, 2018.

The information on revenue recognition that follows is **not** from Accounting Standards Update No. 2014-09 but is the information candidates are currently responsible for. HOCK will publish updated information at an appropriate time. A summary of the new standard follows this section but it is not intended to be a complete explanation, nor is it necessary to know for the current exams.

Revenue is recognized when it is (1) **realized** or **realizable** and (2) **earned**.

- Revenue is **realized** when product (goods or services), merchandise or other assets have been exchanged for cash or claims to cash.
- Revenue is **realizable** when goods or services have been exchanged for assets that are readily convertible into cash or claims to cash.
- Revenue is **earned** when the entity has substantially accomplished what it must do to be entitled to receive the benefits represented by the revenues.

Usually, revenue is recognized at the **point-of-sale**, or when the customer receives the item. However, in some situations revenue is not recognized at the point-of-sale and sometimes other factors are involved in the recognition of revenue.

### Revenue Recognized at the Completion of Production

In some limited cases, revenue and a receivable is recognized immediately upon the completion of production of the item. This can be done only if all three of the following conditions are met:

- The item is **readily saleable** as soon as it is completed,
- There is a **known market price** for the item and there are minimal selling costs, and
- The units are **homogeneous** (identical to each other).

The completion of production method is usually used only for **agricultural products** and **precious metals**. However, it can also be used in a situation where the producing company has already sold the items that it will produce. The fact that the items have already been sold will most likely be evidenced by a contract.

Where there is a contract demonstrating the future sale, as soon as the production of the items is completed, the company recognizes the revenue, the cost of goods sold, and the receivable associated with the items because they have, in fact, been sold. Recognition of the revenue, cost of the goods, and the receivable takes place even if the items have not yet been shipped.

The amount of revenue to recognize is equal to the **contracted selling price** (or market price) multiplied by the number of units produced during the period that are being sold under the contract. Note that the associated production costs must be recognized at the same time as the revenue is recognized.

In some cases, completion-of-production recognition is accomplished by means of the percentage-of-completion method. If the costs of the production are reliable measures of progress on a contract to supply agricultural products or precious metals, revenue under the contract may be recognized in the same manner as it is for construction contracts where both revenue and costs are recognized according to the percentage-



of-completion method. As with a construction contract, the amount of revenue recognized in any period is dependent on the amount of costs incurred and recognized.

FASB Statement of Concepts 5 is the authority for recognizing revenue on the basis of completion-of-production. Paragraph 84c says, "If product is contracted for before production, revenues may be recognized by a percentage-of-completion method as earned—as production takes place—provided reasonable estimates of results at completion and reliable measures of progress are available." Paragraph 84e says, "If products or other assets are readily realizable because they are salable at reliably determinable prices without significant effort (for example, certain agricultural products, precious metals, and marketable securities), revenues and some gains or losses may be recognized at completion of production or when prices of the assets change."

### Installment Method of Profit Recognition

The installment method is used when an item is sold on credit and will be paid over a period of time in the future and the **amount that will actually be collected is not certain**. Under this method, profit is recognized only when the cash is received from the customer. The installment method is a conservative approach to the recognition of profit when the collectibility of future amounts is uncertain.

A receivable is recognized as soon as the sale takes place, but a valuation account is used as well.

At the time of the sale, an Installment Receivable is debited for the entire amount that will be received and the inventory is written off the books. The balance between these two amounts (the profit on the sale) is credited to a Deferred Gross Profit account. The Deferred Gross Profit account is a valuation account in the asset section of the balance sheet. It is a contra-asset account that carries a negative (credit) balance.

The journal entry looks as follows:

Dr	Installment receivable.....	total amount to be received
	Cr	Inventory .....carrying value
	Cr	Deferred gross profit.....profit

This deferred gross profit is recognized only when the cash is actually received from the customer. Whenever cash is collected, some of this deferred gross profit is recognized and moved from the balance sheet to the income statement as profit.

The amount of profit that is recognized when cash is collected is calculated using the following formula. The profit margin is calculated as the total profit on the sale divided by the sales price. The formula to determine the amount of profit to be recognized each time cash is received is:

$$\text{cash received} \times \text{profit margin \%} = \text{profit recognized}$$

Each time cash is received, the company will make the following journal entry:

Dr	Cash.....	amount received
Dr	Deferred gross profit.....	as calculated
Cr	Installment receivables.....	amount received
Cr	Realized gross profit.....	as calculated

### Presentation of Deferred Gross Profit in the Financial Statements

On the financial statements, any remaining balance in the Deferred Gross Profit account is recognized as a contra-asset account to the Installment Receivable. The balance sheet is presented as follows:

	Installments receivable
Less	<u>Deferred gross profit</u>
<b>Equals</b>	<b><u>Net installments receivable</u></b>



This net installments receivable figure represents the amount of the receivable that still needs to be collected just to recover the costs of the sale. The amount of the receivable that will be collected within 12 months is classified as a current asset and the remaining receivable is classified as noncurrent.

**Note:** Generally, the revenue and cost of goods sold related to installment sales are not reported on the income statement—only the recognized gross profit is reported. You will notice that in the first journal entry above that no Cost of Goods Sold account is used. The company is essentially just transferring the inventory amount to a receivable.

However, if the amount of installment sales is significant, the company may disclose the total amount of installment sales and other information relating to the sales in the notes.

Though the topic of installment sales can get very involved for a company that has a lot of installment sales, it is kept at a very straightforward level on the exam.

The **most common questions** that you will be asked are the following:

- How much profit should be recognized in a given year?
- What is the remaining deferred profit?
- What amount of receivables is remaining (and usually this will ask for the total amount of remaining receivables)?

The **solutions** for these three questions are fairly straightforward:

- To find how much profit should be recognized during a given year, multiply the cash received **during this period** by the profit margin.
- To find the remaining deferred gross profit, calculate the total amount of profit from the sale and then subtract all of the profit that has been recognized in all periods since the sale was made (not just this period) by multiplying the profit margin by the total amount of cash that has been collected.
- To find the amount of remaining receivables, subtract the receivables collected to date from the total sales. If the question asks for the **net** receivables it will be the remaining receivables minus the remaining deferred profit.

**Note:** The installment method will be used in very few situations. Therefore, the fact that the company is not recognizing revenue or COGS from these sales is not a major issue.

An example that goes through the journal entries for recording the sale, setting up the receivable, and collecting money is shown on the following page.

Example: Jeffrey Electronics sells computers for \$5,000 each on a deferred payment plan of \$1,000 down with the balance payable in 4 equal quarterly installments of \$1,000. Jeffrey manufactures the computers at a cost of \$3,000.

On October 1, 20X0, Jeffrey sells 1 computer under these terms but is uncertain about the collectibility of all of the amounts.

For Jeffrey, the gross profit percentage on the computer is 40% ( $2,000 \div 5,000$ ). Therefore, every time that Jeffrey receives money, it will recognize 40% of that amount as profit by moving this amount out of the deferred profit account and into the realized profit account.

The journal entries are as follows:

**October 1, 20X0 when the sale is made and the down payment collected**

Dr	Cash.....	1,000
Dr	Installment accounts receivable – 20X0 .....	4,000
Cr	Inventory .....	3,000
Cr	Deferred gross profit .....	2,000

*To record the sale, the collection of the down payment, set up the receivable and set up the deferred gross profit.*

Dr	Deferred gross profit.....	400
Cr	Realized gross profit.....	400

*To recognize 40% of the cash received from the down payment as profit.*

**December 31, 20X0 when the first quarterly payment is received**

Dr	Cash.....	1,000
Cr	Installment accounts receivable – 20X0 .....	1,000

*To record the collection of quarterly payment.*

Dr	Deferred gross profit – 20X0 .....	400
Cr	Realized gross profit.....	400

*To recognize 40% of all of the cash received as profit.*

At December 31, 20X0, Jeffrey's balance sheet should report the following:

Installment receivable	3,000
Deferred gross profit	(1,200)
<b>Net installment receivables</b>	<b>1,800</b>

When payments are received on March 31, June 30, and September 30 of 20X1, the same two sets of entries will be posted as are shown above for December 31, 20X0.

**Interest on the Installment Receivable**

When interest is charged on the outstanding amount of the receivable, it has **no impact on the accounting and profit recognition that was done above**. Any interest received is accounted for and recorded separately from the collection of the cash for the sale. Interest received is accounted for as interest revenue.

The amount of the cash received that is actually interest income will be recorded with the following journal entry:

Dr	Cash .....	X
Cr	Interest revenue .....	X

In a situation where the interest is included in the amount that is paid each time, part of the payment amount is a payment on the principal and part of the amount is interest. The installment receivable will be recorded at the present value of the future payments. Then when each payment is made, a portion of the payment will be recognized as interest revenue (the carrying value of the receivable × the interest rate) and the remaining amount will be a reduction of the receivable.

In summary, when interest is included in the amount of the receivable, the **carrying value of the receivable will be the present value of the remaining payments to be made**.

**Cost Recovery Method of Profit Recognition**

While the cost recovery method of revenue recognition is similar to the installment method, the cost recovery method is even more conservative. In fact, the cost recovery method is the **most conservative method** of income recognition. It is used when the company makes a credit sale and there is **no basis to determine the collectibility of the future payments to be made**.

Like the installment method, all of the profit on the sale is deferred at the time of the sale. However, the cost recovery method is more conservative because the seller recognizes no gross profit until the amount of cash that has been collected exceeds the cost of the sale.

In the example above, under the cost recovery method, Jeffrey would not recognize any profit until the receipt of the June 30, 20X1 payment. However, all of the cash collected by Jeffrey on June 30 and all of the cash collected on September 30 would be recognized as profit.

**Note:** The cost recovery method is very rarely used, but in cases where it is, its use will be disclosed individually in the notes to the financial statements. Also, in a situation using the cost recovery method, it is most certain that the title to the goods will not transfer until complete payment has been made.

The journal entries for the above example using the cost recovery method would be as follows:

**October 1, 20X0 when the sale is made and the down payment collected**

Dr	Cash.....	1,000
Dr	Cost recovery accounts receivable – 20X0.....	4,000
Cr	Inventory .....	3,000
Cr	Deferred gross profit .....	2,000

*To record the sale, the collection of the down payment, set up the receivable and set up the deferred gross profit.*

**December 31, 20X0 and March 31, 20X1 quarterly payments received**

Dr	Cash.....	1,000
Cr	Cost recovery accounts receivable – 20X0 .....	1,000

*To record the collection of the first two quarterly payments and reduce the receivable. There is no recognition of profit because after the first two quarterly payments the cash received is only equal to the cost of sales.*

**June 30 and September 30, 20X1 quarterly payments received**

Dr	Cash.....	1,000
Dr	Cost Recovery Deferred Profit – 20X0.....	1,000
Cr	Cost Recovery Accounts Receivable – 20X0 .....	1,000
Cr	Realized Gross Profit .....	1,000

*To record the collection of the last two quarterly payments, reduce the receivable, and recognize the profit on the income statement.*

### Interest on the Cost Recovery Method Receivable

When interest is included as part of the payment process, **no interest income will be recognized until the total amount of cash received (including both the cash received for the cost of the goods as well as the cash received that is interest) is greater than the cost of goods sold.**

Thus, there will be no income of any kind on the income statement until the total cash received (whether it is for interest or for the goods sold) exceeds the cost of sales.

**Note:** Any interest earned prior to the total cash collected exceeding the cost of the sale is set up as Deferred Interest Income and will be recognized as income on the income statement only when the cash collections exceed the cost of the sale.

### The Deposit Method

In some transactions, not enough of a transfer of the risks and benefits of ownership to the buyer takes place for the seller to recognize revenue. An example is when a company “sells” a subsidiary but still retains a very significant presence in the management and running of the subsidiary. This situation may arise when the buyer does not pay much money and what is paid is a type of deposit, or down payment. It may also occur if the “seller” has the right for some period of time to back out of the sale. In these cases, the seller should not recognize revenue or profit until it is known whether a true sale has taken place.

The journal entry to record the receipt of the deposit is:

Dr	Cash.....	x
Cr	Deposit from purchaser .....	x

The Deposit from Purchaser account is a liability and is shown as a liability until it is determined that a sale has taken place, in which case the full sale journal entry is made. If the seller determines that the sale will not take place and the cash is returned, the journal entry above is reversed.

### Revenue Recognition When the Right of Return Exists

Many companies provide their customers with a certain time period within which they can return an item if they do not like it, if it is damaged, or they have simply changed their minds. If the customer is able to return the item that has been purchased, the question is whether or not the seller should recognize revenue and a receivable, and if so, how much.

In short, the answer is that usually the seller should recognize revenue even if there is a right to return. However, to recognize revenue when there is a right to return, the seller should address the fact that some items will be returned.

If the returns rarely occur, the company can account for a return individually when it occurs. Usually returns are debited to a separate account from the sales revenue account so that management can see how much has been returned. The account is called sales returns and allowances and it generally follows the sales revenue account in the chart of accounts but it carries a debit (negative) balance.

If returns take place frequently and are material, the company should set up an allowance account for returns. An allowance account for returns is handled in the same manner as the allowance for doubtful debts is handled. The allowance for doubtful debts is explained in the next few pages, so it is not described here.

We said above that usually the seller can recognize revenue when a right of return exists. However, in order to recognize revenue, the seller must meet a series of conditions. These conditions are:

- the price of the transaction is substantially fixed or determinable at the time of the sale,
- the buyer has paid for the item or is obligated to pay for the item, and this obligation is not contingent upon the resale of the item,
- the buyer's obligation is not changed in the case of theft, destruction or damage,
- the buyer is a separate entity from the seller,
- the seller does not have future obligations to assist in the resale of the item, and
- **the amount of future returns can be estimated.**

If these conditions are not all met, the seller should not recognize revenue until the right of return has expired or these conditions have been met.

**Note:** The last of the criteria listed above is probably the most important. If the amount of returns can be estimated, the company can recognize revenue when the sale is made and it will set up the corresponding allowance account.

### Sales With Buyback Agreements

Sometimes a company may sell its product in one period and at the same time agree to buy it back in a later period. Even though legal title to the product is transferred, the seller may actually retain the risks of ownership. The terms of the agreement need to be analyzed to determine whether or not the seller has transferred the risks and rewards of ownership to the buyer.

**Two Examples**

**Example #1:** Seller Corporation sells a piece of equipment to Buyer Corporation at price of \$120,000. The cost of the equipment in Seller's inventory is \$100,000. As part of the sales agreement, Seller agrees to repurchase the equipment at the end of three years at its fair value at that time. When Buyer Corporation takes possession of the equipment, Buyer pays the full selling price of \$120,000 to Seller.

In the above scenario, Seller Corporation has fulfilled its performance obligation to Buyer, the risks and rewards of ownership have been transferred to Buyer Corporation, and Buyer Corporation has no restrictions on its use of the equipment. Therefore, a sale has taken place and it should be recorded as sales revenue and the cost to Seller for the equipment should be debited to cost of goods sold and credited to inventory.

**Example #2:** Seller Corporation sells a piece of equipment to Buyer Corporation at price of \$120,000. The cost of the equipment in Seller's inventory is \$100,000. As part of the sales agreement, Seller agrees to repurchase the equipment at the end of three years at a price of \$75,000. Buyer Corporation does not pay Seller Corporation the purchase price but instead signs a note agreeing to pay Seller for the equipment in 36 monthly payments. Seller requires Buyer to maintain the equipment in good condition and maintain insurance on it.

In the second scenario, many of the risks and rewards of ownership have remained with Seller Corporation. Because Buyer is required to maintain the equipment in good condition and insure it and Seller Corporation has agreed to repurchase it at a set price, this is not a sale but rather a financing transaction. The equipment should remain on the balance sheet of Seller Corporation and no revenue should be recognized.

**Channel Stuffing and Trade Loading**

When a manufacturer induces a wholesaler or distributor to purchase more product than the wholesaler or distributor is able to sell in a timely manner, it is called **channel stuffing** or **trade loading**. A manufacturer may do this by offering deep discounts or other incentives. These actions enable the manufacturer to recognize additional revenue and profits in the current period.

However, trade loading and channel stuffing distort operating results and "window dress" financial statements. Trade loading and channel stuffing should not be done because the manufacturer is reporting tomorrow's revenues today. The wholesalers' or distributors' inventories become bloated while the manufacturer's profits are exaggerated, but at the expense of future period profits for the manufacturer. Engaging in such practices is a serious breach of ethics, because it results in financial statements that are misleading.

If a manufacturer does offer incentives to get its wholesalers or distributors to purchase more product, it should record an appropriate allowance for sales returns.

**Long-Term Contracts**

For contracts that take longer than one year to complete, the main issue is when to recognize the profit and how much to recognize in each period. The most common situation for long-term contracts is construction contracts.

Two methods are used for recognizing the profit that is earned on a long-term contract. Both methods are acceptable, but the company must use the same method for all long-term contracts. The two methods are the Completed Contract method and the Percentage-of-Completion method.

### Completed Contract Method

Under the completed contract method, **profit is recognized only at the completion of the contract**. Thus if the construction takes 10 years to complete, no profit is recognized on the income statement of the construction company until the 10th year, when the contract is completed.

The amount of profit recognized is equal to the difference between the contract price and the total cost to complete the project.

### Recognition of Losses Under the Completed Contract Method

Losses are treated differently, however. **Under the completed contract method, any expected losses that may be incurred must be recognized in the period when they become known.** At the end of each period, the company needs to determine the final expected profit or loss on the contract. This is done with the following formula:

$$\begin{aligned} & \text{Contract price} \\ & - \text{Costs **actually incurred** to date} \\ & - \text{Costs **expected** to be incurred in the future} \\ & = \text{Expected profit (loss)} \end{aligned}$$

- If the expected profit (loss) is a loss, the amount of the loss should be recognized in the period when it is incurred.
- If the expected profit (loss) is a profit, however, no profit is recognized until the project is complete.

### Percentage-of-Completion Method

Under the percentage-of-completion method, profit is recognized **as it is earned** throughout the process of completing the project. In order to make this recognition, three calculations must be made at the end of each period:

- 1) The first is to calculate the amount of the total expected profit on the project.
- 2) The second is to determine what percentage the project is completed, based on costs incurred to date.
- 3) The third is to determine how much of the profit should be recognized in the current period. These three calculations will enable the company to determine how much profit should be recognized in a given period.

#### 1) Calculation of Expected Profit

The first calculation is to determine the **expected profit on the contract**. It is calculated in the same manner as for the completed contract method:

$$\begin{aligned} & \text{Contract Price} \\ & - \text{Costs actually incurred to date} \\ & - \text{Costs expected to be incurred in the future} \\ & = \text{Expected Profit (Loss)} \end{aligned}$$

The expected profit (loss) is the amount of profit or loss the company expects from the entire project. However, since the project is not yet complete, the entire amount should not be recognized. The amount to recognize will be determined by what percentage of the project is completed. This leads us to the second required calculation.

## 2) Calculation of the Percentage of Completion

The second calculation determines what percentage of the project is actually complete at the current time. The calculation for this is as follows:

$$\frac{\text{Costs Incurred to Date}}{\text{Costs Incurred to Date} + \text{Expected Costs to Complete}} = \text{Percentage of Completion}$$

**Note:** The percentage of completion is usually determined by looking at the total costs that have already been incurred as a percentage of the total costs expected to be incurred. This method of determining the percentage of completed is called the "cost-to-cost" method. The cost-to-cost method is preferable under U.S. GAAP, but other methods are acceptable if the costs incurred to date as a percentage of total costs expected to be incurred do not provide an accurate estimate of the project's completion. Other acceptable methods include "efforts expended" or "units of work performed." An engineering estimation or other method may be used to make the determination.

The percentage of the contract amount that has been invoiced or collected is not relevant in the determination of the percentage of completion.

## 3) Calculation of the Profit to Recognize This Period

Using the percentage of completion and the total expected profit calculated in 1) and 2), the company can now calculate the amount of profit that should be recognized in total to date. The formula for this is:

$$\text{Expected Profit} \times \text{Percentage Complete} = \text{Total Profit to Be Recognized to Date}$$

However, we still have not calculated the amount of profit that should be **recognized as income this period**. The amount above is how much the company should have recognized in **all periods** that the contract has been in process. In order to calculate the amount of profit to recognize in *this* period, we need to subtract profit previously recognized from the amount calculated above.

This gives us the following:

$$\text{Total Profit to be Recognized to Date} - \text{Profit Previously Recognized} = \text{Profit to Recognize This Period}$$

If we do not eliminate this previously recognized profit, the profit from previous periods will be counted twice (or several times) as the project continues.

All of these calculations and formulas can be combined into one formula for the calculation of profit to recognize in the current period under the percentage-of-completion method:

$$\left( \frac{\text{Costs Incurred to Date}}{\text{Total Costs Incurred to Date} + \text{Estimated Costs to Complete}} \times \text{Expected Profit} \right) - \text{Profit Previously Recognized} = \text{Profit to Recognize This Period}$$

**Note:** The above formula can be used for all long-term contracts in order to determine the profit to recognize in a given period. Even when there are losses (discussed below), the formula can be used if we remember that losses are always 100% complete.

In a situation where the level of expected profit falls from one period to the next, it is possible that this formula will result in a **negative number**. This negative number is the loss that the company needs to recognize in the current period. If the contract in total is not expected to result in a loss, however, the company is not really recognizing a loss having taken place in the period in which expected profit falls. Rather, the company is simply "unrecognizing" some of the gain that was recognized in a previous period.



**Note:** We will show you the journal entries related to long-term contracts beginning on the next page.

### Recognition of Losses Under the Percentage-of-Completion Method

Under the percentage-of-completion method, **any expected loss from a project is recognized in full in the period when it becomes apparent that there will be a loss.** You will remember that this is the same as the way an expected loss is accounted for under the completed contract method.

All losses are immediately recognized, no matter which method is used.

You can still use the formula that is given above for the profit (or rather, loss) to recognize this period, if you simply remember that if a loss is expected for the contract as a whole, it is as if the contract is 100% complete. The actual calculation of the loss to recognize this period will be (Expected Loss) – Profit Previously Recognized. For example, if the total expected loss from the contract (Contract Price – Estimated Total Cost) is \$(100,000) and \$150,000 of profit has been previously recognized, the loss to recognize this period is \$(100,000) – \$150,000, or \$(250,000). Or, to put it more simply, Expected Loss + Profit Previously Recognized = Loss to Recognize This Period.

**Note:** Under the percentage-of-completion method, if in the early years of the project it is expected that there will be a profit, a percentage of that profit is recognized. If, however, in later years the amount of profit expected decreases or becomes an expected loss, previously recognized profit will need to be derecognized. The company does this by recognizing a large loss in the period when the expected loss becomes known. The questions at the end of this discussion demonstrate this concept.

### Journal Entries for Long-Term Contracts

Both the completed contract and the percentage-of-completion methods use the same set of journal entries to record the incurrence of costs, issuance of invoices, and the recognition of expected losses. What is different under the two methods is the recording of expected profit.

#### Recognizing the Incurrence of Construction Costs

Under both methods, the costs of construction that are incurred are put into an account called **construction in progress (CIP)**. This account is used whether the costs are paid for in cash or on account. The difference is simply in the name of the account credited. The journal entry to record the incurrence of costs is below.

The CIP account is essentially an inventory account. However, the costs in the CIP account do not move to finished goods and then to cost of goods sold the way costs in a WIP account do in a manufacturing company. The CIP is merely a “holding” account, and it is temporary.

The journal entry to record expenditures is:

Dr	Construction in progress (CIP) .....	x
	Cr    Cash (or accounts payable) .....	x

#### Recognizing the Issuance of Invoices

Under both the completed contract and the percentage-of-completion methods, when billings are made (invoices sent to the client), the journal entry is:

Dr	Contract receivable .....	x
	Cr    Billings on construction accounts (BCA) .....	x

The BCA account is not a revenue account because revenue is not recognized when invoices are issued. In fact, it is really a liability account or a contra account to CIP. Once an invoice is issued and the client pays the invoice, the company constructing the asset owes the customer a building. As we will see later, the BCA account is netted together with the CIP account.

### Reporting Long-Term Contracts on the Balance Sheet

Even if no profit has been recognized, the long-term contract itself must be recognized on the balance sheet to the extent that it represents a net asset or liability. In these journal entries, the company has created both an asset and a liability. The asset is the CIP account and the liability is the BCA. BCA is a liability because by sending an invoice to the customer, the contractor is promising to deliver something in the future to the customer. The difference between the construction in progress (CIP) and the billings on construction account (BCA) accounts is reported on the balance sheet as either an asset or liability.

- If  $CIP > BCA$ , the difference is reported as a **current asset** (the line item used will be called Costs and Estimated Earnings in Excess of Billings).
- If  $CIP < BCA$  the difference is reported as a **current liability** (the line item used will be called Billings in Excess of Costs and Estimated Earnings).

**Note:** Do not net contracts for presentation on the balance sheet. Report each contract as an asset or as a liability, depending upon where each contract belongs. If the company has contract jobs in both classifications, this will result in both a current asset line and a current liability line on the balance sheet.

### Recording Revenue, Expenses and Profit Under the Percentage-of-Completion Method

In addition to these journal entries to record the incurrence of costs and the issuance of invoices under the percentage of completion method, the company also needs to recognize the amount of revenue, expense, and gross profit each year that is recognizable as calculated above.

In short, what will happen is that the profit that is recognized each year will be placed in the construction in progress (CIP) account along with costs incurred. Costs will be recognized as expenses by **also** debiting an account called Construction Expense. As long as the contract is profitable, the amount of the debit to Construction Expense each period is the actual incurred costs for the period.

Revenue will be recognized in an amount that will result in the correct profit amount when construction expenses are subtracted from it. This allows the income statement to include the revenues and expenses from the long-term contracts, instead of just a single profit figure, which by itself is not very useful.

The entry to recognize the profit for the period is:

Dr	Construction expense.....	actual incurred costs for the period
Dr	Construction in progress.....	profit for period as calculated above
	Cr    Revenue on LT Contracts .....	see * below for calculation

- \* The amount of Revenue on LT Contracts to be recognized is calculated by multiplying the contract amount by the contract's percentage complete, and then subtracting any revenue that was recognized in earlier periods. This is the same process used to calculate the profit to be recognized by using the percentage of completion, which is calculated based on costs incurred as a percentage of total expected costs.

These journal entries will balance if they have been calculated correctly, because the basis for calculating revenue and profit will be the percentage of completion, and those are based on actual costs incurred to date as a percentage of total expected costs; and the amount of construction expense will also be based on the actual costs incurred to date. If the entries do not balance, then something is wrong.

**Note:** The journal entry to recognize profit means that the CIP account will have two items in it under the percentage-of-completion method: the cost of the construction and any profit that is recognized during the construction.

### Recognizing Losses on Long-Term Contracts

When a company realizes that the long-term contract will produce a loss, the amount of the expected loss must be recognized immediately in the period in which it arises.

### Completed Contract Method

Under the completed contract method, recognizing an expected loss is relatively straightforward because no revenue, expense, or profit has been recognized to date. When this situation arises under the completed contract method, the journal entry to record this is simply:

Dr	Loss on long-term contract (income statement) ..amount of loss
Cr	Construction in progress (reduces the asset).....amount of loss

### Percentage-of-Completion Method

When the company uses the percentage-of-completion method, the journal entry to recognize an expected loss is a little bit different from the journal entry when a profit is expected because Construction in Progress is credited instead of debited.

Dr	Construction expense .....balancing amount
Cr	Construction in progress .....reversal of previous profit+total estimated loss on contract
Cr	Revenue on LT Contracts ..... revenue for period

In this situation, the debit to construction expense will not be equal to the actual costs incurred for the period. Instead, it will be equal to the amount of revenue to be recognized for the period plus the amount of profit recognized previously plus the total estimated loss on the contract (it will be a balancing amount in the journal entries).

The amount of loss to recognize is calculated using the same formula that was used to calculate the profit to recognize. However, you need to remember that the loss should be treated as 100% complete in the formula. The total loss to be recognized to date on the contract is the total expected loss for the whole contract, not a percentage based on the percentage of completion.

Furthermore, if the company has recognized any profit during the contract's earlier periods, the amount of loss to recognize (in the period when the expected loss arises) will be larger than the expected loss itself because the company needs to **derecognize** all of the profit recognized earlier, and then **recognize** the expected loss.

### Closing Out a Completed Contract Under the Percentage-of-Completion Method

Recall that profit recognized each period is put into CIP. The included profit increases the value of the CIP, so that, by the end of the contract, the balance in the CIP account will be equal to the total revenue from the contract (costs + profit = revenue). At the end of the contract, the balance in the BCA account will also be equal to the total revenue from the contract, because the BCA account accumulates progress billings, which should be equal to the total contract revenue by the end of the contract. So the final balances in both the CIP account and the BCA account should be equal to the total revenue on the contract and equal to each other. At the end of the contract, then, the BCA and the CIP accounts are closed out against each other by debiting BCA for its accumulated balance and crediting CIP for its accumulated balance.

Dr	Billings on Construction Accounts ..... total contract amount
Cr	Construction in progress ..... total contract amount

That is the reason we said that even though the CIP account is like an inventory account, its balance does not flow to cost of goods sold the way WIP inventory flows to finished goods inventory and then to cost of goods sold in a manufacturing company.

Example: On January 1, Year 1, Knoll Co. entered into a three-year construction contract to build an office building for a software company. The contract is for \$3,000,000. All construction costs are paid in cash as they are incurred. The information for each of the three years is presented in the table below:

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
Actual costs incurred	\$ 600,000	\$1,000,000*	\$1,500,000
Expected costs to complete	<u>1,800,000</u>	<u>800,000</u>	<u>0</u>
Total estimated costs	\$2,400,000	\$2,400,000	\$3,100,000
Expected profit (loss)	\$ 600,000	\$ 600,000	\$( 100,000)
Amount invoiced	\$1,000,000	\$1,000,000	\$1,000,000
Percentage complete	25%**	66.67%	100%

\* Note that these are the costs incurred in Year 2. The accumulated costs at the end of Year 2 are \$600,000 + \$1,000,000 = \$1,600,000. In total, the company had incurred \$1,600,000 of costs on the contract during Years 1 and 2.

\*\* Calculated as \$600,000 incurred-to-date divided by total expected costs of \$2,400,000.

The journal entries made under the percentage-of-completion method for each year in order to record the profit or loss are below.

### Year 1

Dr	Construction in progress (CIP).....	600,000
	Cr Cash.....	600,000
Dr	Accounts receivable .....	1,000,000
	Cr Billings on construction accounts (BCA) .....	1,000,000

*To record the incurrence of costs and the issuance of the invoices.*

Dr	Construction expense.....	600,000
Dr	Construction in progress (CIP).....	150,000
	Cr Construction revenue .....	750,000

*After the first year, Knoll has recognized \$150,000 of profit because the company has completed 25% of the project and the expected total profit is \$600,000.*

At the end of Year 1, the CIP account has a balance of \$750,000: the construction expense incurred during Year 1 plus the profit recognized for Year 1.

### Year 2

Dr	Construction in progress (CIP).....	1,000,000
	Cr Cash.....	1,000,000
Dr	Accounts receivable .....	1,000,000
	Cr Billings on construction accounts (BCA) .....	1,000,000

*To record the incurrence of costs and the issuance of the invoices.*

Dr	Construction expense.....	1,000,000
Dr	Construction in progress (CIP).....	250,000
	Cr Construction revenue .....	1,250,000

*After the second year, Knoll has recognized \$400,000 of profit (\$150,000 the first year and \$250,000 in the second year), since the company has completed 66.67% of the project and the expected total profit is \$600,000.*

At the end of Year 2, the CIP account has a balance of \$2,000,000: the \$750,000 at the end of Year 1 plus construction expense of \$1,000,000 for Year 2 plus profit of \$250,000 for Year 2.

(Continued)

**Year 3**

Dr	Construction in progress (CIP) .....	1,500,000
	Cr Cash .....	1,500,000
Dr	Accounts receivable .....	1,000,000
	Cr Billings on construction accounts (BCA) .....	1,000,000

To record the incurrence of costs and the issuance of the invoices.

Dr	Construction expense .....	1,500,000
	Cr Construction revenue .....	1,000,000
	Cr Construction in progress (CIP) .....	500,000

After the third year, Knoll has recognized \$100,000 of **loss** on the contract (\$150,000 profit in the first year, \$250,000 in the second year and a loss of \$500,000 in the third year). Knoll has completed the project and the costs of the project were \$100,000 more than the revenues. Revenue was \$3,000,000 and costs were \$3,100,000 (\$600,000 + \$1,000,000 + \$1,500,000).

At the end of Year 3, the CIP account has a balance of \$3,000,000: the \$2,000,000 balance at the end of Year 2 plus construction expense of \$1,500,000 incurred in Year 3 minus the loss of \$500,000 in Year 3.

**Sale of the Building**

When the contract is complete and the building is sold to the other company, the following journal entry will be recorded to close out the CIP and BCA accounts for the contract:

Dr	Billings on construction account (BCA) .....	3,000,000
	Cr Construction in progress (CIP) .....	3,000,000

No revenue or expenses are recognized in the journal entry for the final sale, because the revenue and expenses were recognized as the costs were incurred. The journal entry above is necessary only to close the BCA and CIP accounts. After they are closed out, they both disappear, leaving only the construction revenue account containing the total revenue on the contract and the construction expense account containing the costs on the contract.

**Note:** In an exam question, you may need to simply calculate the amount of profit to be recognized in a period. However, you may also need to use the formulas to solve for the amount of costs incurred, expected costs to be incurred, revenue to recognize in a period, or the contract price. To solve for each of these items, simply use the formulas but solve for a different variable.

**Changes in Revenue Recognition Standards**

As noted at the beginning of this topic, on May 28, 2014, the FASB issued Accounting Standards Update No. 2014-09, *Revenue from Contracts with Customers (Topic 606)*. For a public entity, the amendments are effective for annual reporting periods beginning after December 15, 2016, including interim periods within that reporting period (that is, for a calendar year-end public entity, the changes take effect beginning January 1, 2017).

The revenue recognition process was evaluated for a number of years by the FASB and the IASB before the new standard was announced. The new standard was needed because the topic of when a sale becomes revenue has become increasingly complex in recent years. Many times a sale includes multiple components and the seller's obligations with respect to the various components are fulfilled at different times.

Furthermore, under current guidance the same essential transaction might be accounted for differently by different entities because of industry-specific guidance that differs from industry to industry. Under the new guidance, principles for recognizing revenue will be consistent regardless of industry.

The core principle of the new guidance is:

**Recognize revenue to depict the transfer of promised goods or services to customers in an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services.**

Five steps are to be followed in order to achieve this core principle:

- 1) Identify the contract with a customer.
- 2) Identify the performance obligations (promises) in the contract.
- 3) Determine the transaction price.
- 4) Allocate the transaction price to the performance obligations in the contract.
- 5) Recognize revenue when (or as) the reporting organization satisfies a performance obligation.

Full information on the new revenue recognition guidance will be published by HOCK when it is needed for the CMA exams. The new standard will not be tested until January 1, 2018.

Question 48: Paulson Company uses the percentage-of-completion method to account for long-term construction contracts. The following information relates to a contract that was awarded at a price of \$700,000. The estimated costs were \$500,000, and the contract duration was three years.

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
Cumulative cost to date	\$300,000	\$390,000	\$530,000
Costs to complete at year end	250,000	130,000	0
Progress billings	325,000	220,000	155,000
Collections on account	300,000	200,000	200,000

Assuming that \$65,000 was recognized as gross profit in Year 1, the amount of gross profit Paulson recognized in Year 2 was

- a) \$49,950
- b) \$70,000
- c) \$124,950
- d) \$135,000

(ICMA 2008)

**The following information is for the next three questions:** Carefree Construction recognizes construction revenue and expenses using the percentage of completion method. During 20X0, Carefree began a single, long-term project for a contract price of \$1,500,000, which continued through 20X3. Information on the project follows:

	<u>Costs incurred</u>	<u>Estimated costs to complete</u>
20X0	\$ 400,000	\$800,000
20X1	600,000	700,000
20X2	1,350,000	200,000
20X3	1,550,000	0

Question 49: For the year 20X0, what is the amount Carefree should recognize as gross profit from this project?

- a) \$0
- b) \$75,000
- c) \$100,000
- d) \$375,000

Question 50: For the year 20X1, what is the amount Carefree should recognize as gross profit from this project?

- a) \$7,692 loss
- b) \$33,000 loss
- c) \$0
- d) \$92,308

Question 51: For the year 20X2, what is the amount Carefree should recognize as gross profit from this project?

- a) \$142,308 loss
- b) \$92,308 loss
- c) \$50,000 loss
- d) \$0

(Source Unknown)

Question 52: Rose Construction Company had the following year-end data on a long-term construction contract started in 20X2 with a contract price of \$100,000.

	<u>20X2</u>	<u>20X3</u>
Construction cost	\$30,000	\$40,000
Estimated completion costs	50,000	0
Selling, general and administrative expenses	10,000	10,000

What is the amount of revenue that will be reported in 20X3 using the percentage-of-completion method?

- a) \$37,500
- b) \$40,000
- c) \$50,000
- d) \$62,500

(ICMA 2003)

## Differences Between U.S. GAAP and IFRS

In this section, we will review the major differences in reported financial results when using U.S. GAAP versus IFRS. The impact on financial statement analysis that these different accounting standards will have is also discussed.

We will cover the following topics:

- General background information regarding IFRS.
- Important general considerations for a financial analysis regarding IFRS and its differences with U.S. GAAP.
- Why it is important to understand the differences between IFRS and U.S. GAAP.
- A comparison of selected areas of the financial statements including similarities between the standards, primary differences, important facts regarding the IFRS accounting treatment, and a general review of the impact on financial analysis associated with the variances.
- A detailed illustration how to perform a transition to IFRS and how this transition would impact financial ratios used in a financial statement analysis.

Once you have completed this section you will be able to:

- Perform financial analysis of companies that transition their accounting standards from U.S. GAAP to IFRS.
- Compare a company that reports in U.S. GAAP to a company that reports in IFRS.
- Explain how a company's transition to IFRS will impact the financial statement analysis of that company.

## General Background Information Regarding IFRS

We will start by reviewing what IFRS is and what it has in common with U.S. GAAP.

IFRS stands for "**International Financial Reporting Standards**." It is a widely accepted set of accounting principles that is in use outside the USA in most countries. It has largely replaced the individual country GAAP that existed in the countries that now use IFRS. Therefore, as its name indicates, you should think of IFRS as "International" GAAP compared to "U.S." GAAP.



The reference to “GAAP” is important. IFRS is an accounting standard for commercial business. It is not a tax standard nor does it apply to government organizations. You will learn that the differences between IFRS and U.S. GAAP are not as severe as, for example, the differences between the U.S. tax code and U.S. GAAP. In fact, the general principles, conceptual framework and accounting results between U.S. GAAP and IFRS are often very similar, if not the same. This is because the two standards are more alike than different for most common transactions.

Yet there are differences between the two standards, and there are several reasons for these differences:

- Some differences are intentional deviations where international standard setters tried to avoid perceived weaknesses in U.S. GAAP where the U.S. standard, in their eyes, appeared overly influenced by the domestic USA environment (political pressure, U.S. cultural and legal practices, etc.).
- Sometimes a difference exists because the IFRS standard was designed to avoid implementation issues that became visible based upon actual practice difficulties when the related U.S. GAAP standard was implemented. IFRS has its roots in actions by international, non-U.S. standard setters from the early 1970s. In fact, it has only become a high priority outside the U.S. in the last 15 to 20 years. Therefore it has benefited from practical experience in the USA for many of the more recent IFRS standards.
- Most often differences exist because of the core nature of IFRS compared to U.S. GAAP. IFRS is primarily a **principles based** accounting standard with few practical examples and limited interpretative guidance for individual industries. It is intended to apply to multiple countries with the associated cultural, legal, and commercial differences that exist in different countries. Since IFRS is intended to be more open and flexible, the standard setters leave interpretation to companies and their auditors. U.S. GAAP, on the other hand, is largely a **rules based** body of standards with extensive interpretive guidance for individual industries and specific examples for auditors and practitioners to follow. Its target audience is USA based entities or foreign companies that participate in the American financial markets. In addition, the standard setters are active in the interpretation of the standard; this active participation often results in a more proscriptive approach in U.S. GAAP that reflects the strong regulatory and legal environment in the USA.

One fact illustrates these fundamentally different approaches between IFRS and U.S. GAAP. IFRS is covered in 1 book about 2 inches thick. U.S. GAAP is covered in at least 3 FASB paperbacks, approximately 9 inches thick, plus reports with emerging taskforce issues plus authoritative interpretations.

As a result of this flexibility within IFRS, there are often interpretation differences that arise within IFRS. Different companies and their auditors can interpret IFRS differently. The significance of these differences will vary from company to company depending upon factors such as the nature of the company’s operations, the industry in which it operates, and the accounting policies that it chooses (there are acceptable alternatives in multiple areas).

The standards for lease accounting illustrate the principle-based nature of IFRS and the rules based nature of U.S. GAAP. As a result of these differences, the two standards can give different accounting treatments to the same lease. Also, it would be possible for two companies reporting under IFRS to come to different conclusions about the treatment of an identical lease. U.S. GAAP has precisely defined criteria for the recognition of capital leases. One criterion under U.S. GAAP is that a capital lease exists if the lease term is equal to or greater than 75% of the asset’s economic life. IFRS has a similar condition but refers to a “major part” of the asset’s economic life, rather than a specific percentage. U.S. GAAP also refers to 90% of the asset’s economic fair value whereas IFRS refers to “substantially all” of the fair value. These examples make it clear how auditors and practitioners could view the same facts about a transaction and come to dramatically different conclusions about the correct accounting treatment.

We stated earlier that the U.S. is in the process of some sort of convergence with IFRS. This raises the questions of what would be the benefits for a U.S. company to convert to IFRS. By adopting IFRS:

- A business can present its financial statements on the same basis as its foreign competitors, making comparisons easier for potential investors.
- A company may use one accounting standard worldwide when it has subsidiaries in countries that require or permit IFRS. This standardization on one accounting standard could result in lower accounting and auditing costs.
- A company also may need to convert to IFRS if it is a subsidiary of a foreign company that must use IFRS.
- Companies may also benefit by using IFRS if they wish to raise capital abroad.

### Important Considerations about IFRS Financial Analysis Compared to U.S. GAAP

Now that we have introduced IFRS as a concept, we will briefly review the major issues that are faced when performing a financial analysis where both IFRS and U.S. GAAP are involved.

A change from U.S. GAAP to IFRS is accounted for as a change in accounting principles. Financial statement analysis involving a change in accounting principles can be very complex because:

- It is necessary to understand the new accounting principle,
- It is necessary to understand how the new principle impacts the company, and
- Sometimes it is necessary to restate the financial results of one company to ensure the comparability between companies if the change in principles is done at different times and the analysis involves multiple companies.

This complexity of accounting changes is severe enough when one accounting standard is changed within a single set of accounting principles like U.S. GAAP. It is even worse when the entire set of principles is changed and the entire financial statements are subject to change. This is what happens when a company transitions from U.S. GAAP to IFRS.

Therefore try to keep the following general considerations in mind for your financial statement analysis work when you are working with companies that use IFRS and U.S. GAAP:

- **Are differences in the financial results only timing differences and, if yes, when is the reversal of the difference?**

IFRS and U.S. GAAP are accounting principles. They do not impact the economic (cash flow) activity that they are intended to represent. Therefore the same cash flow impact of the business activity will occur in both sets of financial statements (IFRS and U.S. GAAP) – the question is only when.

This question is important because the scope of a typical financial analysis is generally limited to a few years. So the question is whether the timing difference between the two accounting standards is completely reversed within the timeframe of the analysis. If the answer to this question is no, then it might appear that the transition to IFRS has created a “permanent” change in a financial ratio and your analysis of the IFRS financial statement will need to consider and compensate for this event. The analysis must make clear that this “permanent” change is not really permanent, just the result of a timing difference that is reversed outside the timeframe of the analysis.

- **Does the IFRS principle result in a reclassification of a financial statement position from one type of financial statement category to another?**

Most differences between the two standards involve timing and measurement differences for a specific business activity. The nature of the activity itself is not changed and the external financial reporting is untouched. (Example: an accounts receivable in IFRS is an accounts receivable in U.S.

GAAP. There are no variances between the standards that will impact this financial statement category.)

However, a transition to IFRS sometimes reclassifies activities from one type of financial statement category to another. For example, IFRS might report a transaction as a liability whereas U.S. GAAP classifies it as equity. This difference is a permanent difference and will have a permanent impact on the financial statements. Simply as a result of the change in accounting standards, a company will have more debt and less equity on their balance sheet. This makes it appear that the IFRS based company has more external claims on the cash of the company than the U.S. GAAP company, when in fact this conclusion is not correct. The business activity is the same and the economic outcome is the same – only the financial reporting is different. The analyst needs to consider how this reclassification has altered the financial ratios of the company and adjust the analysis accordingly.

Other examples of permanent reclassifications include variances between inventory and fixed assets, revenue and interest income, and profit/loss versus comprehensive income and equity.

- **What further consequence might result from the changed accounting results that arise from a transition from U.S. GAAP to IFRS?**

Financial analysis needs to consider the possible follow-on consequences of the results of the accounting change. For example, a reclassification of an activity from equity to liabilities could result in non-compliance with debt agreements or lower debt ratings. Therefore interest expense on other debt would be higher. Some differences regarding share-based payment methods will result in permanent differences in the amount of the associated compensation expense. This difference in compensation expense will impact the related payroll taxes. These follow-on consequences will depend on the activities and specific situations of each business.

- **What are the actual detailed accounting principles of the company being analyzed?**

Not only does the analyst need to know that the company being analyzed uses IFRS, but they also need to know how the company interprets and implements IFRS. As already stated, this process of implementation and interpretation can be company specific within the guidelines and alternatives that IFRS provides.

- **Are the changes between the two principles material enough that their impact on the financial statements would be reported externally in footnotes or other sources of information?**

Many differences involve details of accounting transactions that are not generally available externally. As a result, you will know that an accounting principle has changed but you may not know the impact. The analyst will need to make a judgment how to address this situation.

- **How does the analysis consider other comprehensive income compared to profit and loss?**

In IFRS, there are several situations where a transaction impacts other comprehensive income instead of the profit and loss statement. In these cases the analyst must decide how to treat comprehensive income in any analysis involving income results. (Use only net income? Use only total comprehensive income? Exclude portions of comprehensive income not relevant to the analysis?)

### Why the Differences Between IFRS and U.S. GAAP Are Important

Understanding the differences between IFRS and U.S. GAAP is important because the USA is moving toward some form of convergence between U.S. GAAP and IFRS as part of the worldwide effort to create a single set of global accounting standards.

For many years U.S. accounting standard setters and government authorities have been expressing their support for the development of this type of global accounting standard that could serve as a framework for financial reporting for global business. Recently the SEC stated its continued belief that a single set of high-quality globally accepted accounting standards would benefit U.S. investors. It repeated its support for the ongoing efforts toward convergence of U.S. GAAP and IFRS.

Significant proposals have, in fact, been implemented by U.S. standard setters to invest in IFRS and reconcile differences between IFRS and U.S. GAAP. These actions have created a very real prospect that U.S. companies may be able to transition to an IFRS-like accounting standard within the next 5-7 years.

This possibility creates the need for a heightened awareness of the differences between IFRS and U.S. GAAP. Although these longstanding convergence projects between the international standard setters and U.S. standard setters have reduced the extent of differences between IFRS and GAAP, significant differences remain, any one of which can result in significantly different reported results depending on a company's industry and individual facts and circumstances.

The SEC has stated it expects 2015 is the earliest possible date for the use of IFRS by U.S. public companies. Also there are differences between the two standards and it is unlikely that all of the differences will be completely eliminated in the foreseeable future (although significant progress and commitment is made by both sides).

Therefore, a knowledge and understanding of these differences is important for finance and accounting professionals. That is why the IMA has included an understanding of these differences as a learning requirement for the CMA exam.

### Specific Primary Differences Between IFRS and U.S. GAAP

We will now go into the details of the significant differences between the two standards and how these variances could affect financial statement analysis. We will cover the following areas:

- **Inventories** (costing methods, valuation and write-downs (e.g., LIFO)),
- **Revenue Recognition** (the sale of goods, services, deferred receipts and construction contracts),
- **Expense Recognition** (share-based payments and employee benefits),
- **Intangible Assets** (development costs and revaluation),
- **Leases** (leases of land and buildings),
- **Long-lived Assets** (revaluation, depreciation, and capitalization of borrowing costs),
- **Impairment of Assets** (determination, calculation and reversal of loss), and
- **Financial Statement Presentation** (extraordinary assets and changes in equity).

#### 1) Inventories (Costing Methods, Valuation and Write-downs)

The primary source of IFRS guidance is:

- **IAS 2:** Inventories

The primary source of U.S. GAAP guidance is:

- **ASC 330–10:** Inventory general

#### Similarities between standards:

- Inventory is defined as assets held for sale in the ordinary course of business, in the process of production for such sale, or to be considered in the production of goods or services.
- The primary basis of accounting for both standards is cost.
- Permitted methods for cost measurement, such as standard cost or retail method, are similar under both standards.
- Both standards require the cost of inventory to include all direct expenditures to ready inventory for sale, including allocable overhead. Selling expense, most storage costs, and general administrative costs are excluded from cost of inventory.

## Significant differences between standards:

Main Topic	Subtopic	IFRS requirement	U.S. GAAP requirement
Costing methods	LIFO	Prohibited	Permitted
Costing methods	Consistent use of costing method	The same cost method <b>must</b> be applied to all inventories similar in nature or use to the company.	The same cost method <b>is not explicitly required</b> for all inventories similar in nature or use to the company.
Valuation	General guideline	Inventory is carried at the lower of cost or <b>net realizable value</b> . Net realizable value is the best estimate of the expected realizable value of the inventory. It may differ from fair value.	Inventory is carried at the lower of cost or <b>market</b> . Market is defined as current replacement cost as long as market is not greater than net realizable value (ceiling) and is not less than net realizable value reduced by a normal sales margin (floor).
Valuation	Treatment of Asset Retirement Obligations (ARO), such as decommissioning and restoration costs that arise during the production of inventory	An ARO that is incurred because the relevant asset is used to produce inventory is accounted for as a cost of the inventory.	An ARO that is incurred because the relevant asset is used to produce inventory is accounted for as a cost of the carrying amount of the related property plant and equipment.
Write downs	Reversal of inventory write-downs	Previously recognized inventory write-downs <b>are reversed</b> up to the amount of the original loss when the reasons for the write-down no longer exist. The reversal of a write-down is required if certain criteria are fulfilled. (1)	Any write-downs of inventory to the lower of cost or market <b>cannot be reversed</b> .
Write downs	Permanent inventory markdowns under the retail inventory method (RIM)	Permanent markdowns under the retail inventory method (RIM) <b>affect</b> the average gross margin used in applying RIM. Reduction of the carrying cost of inventory to below the lower of cost or net realizable value is not allowed.	Permanent markdowns under the retail inventory method (RIM) <b>do not affect</b> the average gross margin used in applying RIM. Instead these markdowns reduce the carrying cost of inventory to net realizable value less an allowance for an approximately normal profit margin. This value <b>may be less</b> than both original cost and net realizable value.

(1) The amount of the inventory write-down is reversed into profit and loss when:

- The circumstances no longer exist that previously caused inventories to be written down below cost, **or**
- There is clear evidence of an increase in net realizable value because of changed economic circumstances

The reversal is limited to the amount of the original write-down. The new carrying amount of the inventory is the lower of the cost and the revised net realizable value.

### Impact on Financial Analysis when changing from U.S. GAAP to IFRS:

General impacts on financial statement analysis from these variances regarding inventory accounting are:

- Discontinuing the usage of LIFO (which is not allowed under IFRS):
  - Initially the change results in higher inventory value and accounting profits for the IFRS based company.
  - Liquidity ratios and profitability ratios for the IFRS company would be positively impacted in the short term because of the higher current asset values and the higher profits.
  - Asset ratios and activity ratios involving inventory would be negatively impacted for the IFRS company because of the higher inventory carrying values.
  - More importantly, this change would be ongoing and almost permanent in effect if the levels of physical inventory remain constant or increase over multiple years and prices for the inventory are constant or increasing.
  - If the level of inventory declines, then the impact of this change would be reversed.
- Changing the accounting treatment for asset retirement obligations (AROs):
  - It would result in a permanent increase in the reported inventory value and a permanent reduction in the property plant and equipment value for the IFRS company.
  - Liquidity ratios for the IFRS company would be positively impacted by the higher current asset value.
  - Accounting profits for the IFRS company would be negatively impacted initially. This reduction would be a timing difference. The expense in IFRS would flow more quickly into the profit and loss under IFRS as a cost of inventory compared to a depreciation expense over the life of the long-lived asset under U.S. GAAP.
  - The timeframe for the financial analysis is therefore important in order to understand the significance of this timing difference. There could be a long time difference between the expense recognition in IFRS and U.S. GAAP. Would this difference create, in effect, a de facto permanent difference in profitability? The analyst would need to consider and adjust for this situation.
- Other differences regarding inventory carrying values (market value versus net realizable value, permanent inventory markdowns under RIM, and reversal of inventory write downs) would have more limited impact:
  - These differences would result in timing variances in the inventory carrying values and the company's profitability.
  - Liquidity ratios and profitability ratios for the IFRS company would be positively impacted in the short term because of the higher current asset values and the higher profits.
  - Asset ratios and activity ratios involving inventory would be negatively impacted for the IFRS company because of the higher reported inventory values.
  - This change is only a short-term timing difference since we should assume that any impaired inventory would be sold within a reasonable time once it is revalued upwards. It should be viewed as a temporary difference in a financial analysis that nets to -0- within the timeframe of most analysis.
  - These differences would be temporary variances that would generally be reversed within the timeframe and the scope of a financial analysis since inventory will be sold quickly in most companies.

## 2) Revenue Recognition (Sales, Deferred Receipts and Construction Contracts)

The primary sources of IFRS guidance are:

- **IAS 11:** Construction Contract Accounting
- **IAS 18:** Revenue

The primary source of U.S. GAAP guidance is:

- **ASC 605:** Revenue recognition

### Similarities between standards:

- Revenue is based upon completion of the earnings process and the resulting generation of an asset or a reduction in a liability.
- Revenue is not recognized until it is both realized (or realizable) and earned.
- Revenue requires transfers of risk.
- Similar criteria for the recognition of revenue exist. (Example: IFRS states that the value of the revenue can be measured reliably. U.S. GAAP states that the value is fixed and determinable.)
- Separate accounting exists for multiple elements of a business arrangement.
- The standards share a definition of revenue that is, in substance, very similar. IFRS defines revenue as "the gross inflow of economic benefits during the period arising in the course of the ordinary activities of a company when those inflows result in increases in equity other than increase related to contributions from equity participants." U.S. GAAP defines revenue as the actual or expected cash inflows that have or will occur as a result of the company's ongoing major operations.



## Significant differences between standards:

Main Topic	Subtopic	IFRS requirement	U.S. GAAP requirement
Sale of goods	General requirements	Revenue is recognized when: (1) the risks and rewards of ownership have been transferred, (2) the buyer controls the goods, (3) the revenues can be measured reliably, <b>and</b> (4) it is probable that the economic benefits will flow to the company.	Revenue is recognized when it is <b>realized or realizable</b> , and when it is <b>earned</b> . This usually takes place when: (1) there is persuasive evidence of a contractual arrangement, (2) delivery has occurred, (3) the revenue is fixed and determinable, <b>and</b> (4) collectability is reasonably assured.
Services	Usage of long term contract accounting	Revenue <b>may be</b> recognized using long-term contract accounting, including consideration for the state of completion, whenever revenues and costs can be measured reliably, and it is probable that the economic benefits of the activity will flow to the company	Sometimes service revenue recognition is included in industry specific guidance (example: software). <b>Unless permitted otherwise in an industry specific standard</b> , use of long-term contract accounting is <b>not permitted</b> for non-construction services.
Services	Preferred method of service revenue recognition	Revenue from service contracts is recognized in the period that the service is rendered, <b>generally using the percentage of completion method</b> .	Revenue from service contracts is recognized in the period that the service is rendered, <b>generally using the straight line method</b> rather than the percentage of completion method.
Deferred receipts	Discounting the cash flows	Revenue value is determined by <b>discounting all future receipts</b> using an imputed rate of interest. This type of activity is considered to be a financing agreement. (1)	Discounting is required <b>only in limited situations</b>
Construction contract accounting	Completed contract method	<b>NOT permitted</b>	<b>Permitted</b>
Construction contract accounting	Required method if percentage of completion cannot be determined reliably	Revenue is recognized using the percentage of completion method if certain criteria are met. If the percentage of completion cannot be determined, <b>revenue is limited to recoverable costs incurred</b> (cost recovery method). (2)	Revenue is recognized using the percentage of completion method only if certain criteria are met. If the percentage of completion cannot be determined, <b>the completed contract method is used</b> .
Construction contract accounting	Cost recognition using the percentage of completion method	Under the percentage of completion method, both contract revenue and costs are recognized by reference to the <b>stage of completion of the work</b> .	Under the percentage of completion method, contract revenue and costs are recognized by reference to the stage of completion of the work. <b>However, it is permitted to recognize all costs incurred, with the revenue calculated by reference to the gross margin earned on the contract during the period</b> .
Construction contract accounting	Combining or segmenting contracts	Construction contracts <b>are combined or segmented</b> if certain criteria are met. Criteria under IFRS differ from those in GAAP.	Construction contracts <b>may be, but are not required to be</b> , combined or segmented if certain criteria are met.



(1) IFRS requires the use of the **effective interest method** to recognize the difference between the nominal cash value to be received from the customer and the net discounted cash flow value used to record the revenue. The difference between the actual cash to be received and the discounted value of the cash flows is recorded as interest income over the contracted payment term.

(2) **When the percentage complete is not determinable**, IFRS requires that revenue is limited to **recoverable** costs. No profit may be recognized because the project outcome is not determinable. Expenses are recognized as incurred.

If a **portion** of the project costs **are not recoverable** and the outcome of the project **cannot be determined**, then IFRS requires that **no revenue** is recognized until the uncertainties about the project outcome are eliminated. All costs are recognized as incurred.

### Impact on Financial Analysis when changing from U.S. GAAP to IFRS

Any financial analysis of a company with changing revenue recognition policies must first consider the connection, if any, between revenue recognition accounting policy and the company's customer billing practices. Generally, financial statement analysis assumes that the company's standard customer billing practice is to invoice the customer as soon as commercially possible in agreement with the customer. But this assumption would need to be confirmed as part of the analysis.

- This confirmation is important because there can be a significant disconnect between the timing of the billing and the revenue recognition. The analyst needs to understand this difference.
- Usually this disconnect exists for services based upon long term contracts where invoicing is done in advance of the service performance. In other cases it could occur when advance payments are made prior to the shipment of goods.
- In both these cases there will be cash flows that are initially accounted for as current assets and current liabilities (rather than as a revenue).

**Example:** Let us assume that a company's billing practices are not changed when they adopt IFRS. Because of this, the actual cash inflows from customers are not impacted. This makes the conversion to IFRS purely an accounting and financial reporting issue. It will not impact the way that the business operates.

General impact on financial statement analysis from these differences is:

#### Deferred receipts:

- The IFRS requirement to discount the cash flows for contracts with deferred receipts will result in lower accounting revenue for the IFRS based company compared to the U.S. GAAP based company.
- This lower revenue will impact any analysis of the IFRS company based upon accounting revenue. Profit margin analysis, certain operating activity ratios, and any other analysis with revenue as a denominator will be better for the IFRS company because they will have the same profit, but from a lower level of revenue.
- Note that this difference between the revenue values is permanent. It is permanent because of the different measurement basis and how this difference is treated.
- The use of the effective interest method in IFRS will also result in a difference in the reported profit. This difference impacts both the timing of the profits and the "type" of profits.
  - The **timing of profits** is negatively impacted for the IFRS company because the interest income is recognized as earned – generally meaning over the period when the customer makes his cash payments. Under U.S. GAAP the full profit from the transaction is recognized immediately when the revenue is recognized.

- The **type of profit** is impacted because a portion of the IFRS profit results from interest income (generally not viewed as a core part of a company's operations) whereas the U.S. GAAP profit comes from a sale (the company's core operations). Generally profit from sales is viewed more favorably since it is seen as the more reliable indicator about the company's ongoing ability to generate profits.

#### **Cost recognition using the percentage of completion method for a service project:**

- If a company has used the U.S. GAAP option to recognize all service costs as incurred and to recognize revenue based upon the gross margin earned in the period, then the financial analysis of the company would be impacted if the company changes to IFRS.

In this case there would be a timing difference between the recognition of revenue and profit since the IFRS based company would generally record revenue more closely aligned to the costs incurred (assuming that the stage of completion is closely aligned to the costs incurred).

This timing difference would depend upon the nature of the contract – each contract has different characteristics that could impact the calculation of revenue. If the service project does not last for a period longer than the period of analysis, the timing difference would be temporary.

- If the service period extended beyond the timeframe of the analysis, then the difference would not be reversed within the scope of the financial analysis and an adjustment would have to be made to compensate for this situation.

#### **Completed contract method:**

- If a company is using the completed contract method of revenue recognition under U.S. GAAP, this fact often means that the company is not able to reliably estimate the stage of completion of a construction project. Therefore a conversion to IFRS would require that the company recognize revenue only to the extent of recoverable costs.
- This fact results in the following accounting treatment:
  - Under IFRS the company will record revenue and will an equal amount of associated expenses. The profit is -0-.
  - Under U.S. GAAP the company has no revenue and no expenses since the completed contract method of revenue recognition requires that the expenses be accumulated on the balance sheet until the project is completed. The profit under U.S. GAAP is also -0-.

This difference in the two methods means that most analysis using revenue alone will initially appear more positively under IFRS because revenue is recognized sooner than under U.S. GAAP. This timing difference is temporary and would generally reverse within the usual time frame of a financial analysis.

- There will also be an impact on certain types of analysis for profitability. This impact will occur even though the actual profit recorded is -0- in absolute terms for both standards.
  - A profitability analysis based upon a % of revenue will be worse for the IFRS company because the IFRS accounting treatment results in revenue with -0- profit. The profit margin is therefore 0%.
  - Under U.S. GAAP there is no revenue, no expense and no profit margin.
  - A profit margin of 0% would need to be investigated and understood that it arises from an accounting timing difference and not from the true economic performance of the contract.
- Net asset values generally will not be impacted because the IFRS company will have a revenue related impact to its asset or liability values from the revenue that it records that will offset the accumulated costs on the balance sheet for the U.S. GAAP company.

**Preferred method of revenue recognition: percentage of completion versus straight line:**

- A company using the straight-line method of revenue recognition on a service contract could have a different profit result for a financial period compared to a company using the percentage of completion method.
- This variance would be a timing difference that occurs because revenue is being recognized (evenly over a defined period) independent of when the costs are incurred. This difference will most usually be a temporary difference since most service contracts will conclude during the timeframe that is normally included within the scope of a typical financial analysis.
- This timing difference would impact any analysis of a company based upon profitability.
- Revenue based analysis could also be impacted. It is possible that revenue would be recognized earlier under IFRS if project costs are incurred at the beginning of a contract. IFRS based financial ratios using revenue would be more positive. Again, this positive impact is a temporary timing difference in most cases.

**3) Expense Recognition (Share-based Payments and Employee Benefits)**

The primary source of IFRS guidance is:

- **IAS 19:** Employee benefits
- **IFRS 2:** Share based payments

The primary source of U.S. GAAP guidance is:

- **ASC 712:** Compensation – Nonretirement post employment benefits
- **ASC 715:** Compensation – Retirement benefits
- **ASC 718:** Compensation – Stock compensation

**Similarities between standards:**

- Both standards require a fair value based approach to accounting for share-based payment arrangements whereby a company **acquires goods or services** in exchange for issuing share options (or other equity instruments) **or incurs liabilities** that are based, at least in part, on the price of its shares (or that may require settlement in its shares).
- Both standards require that the **fair value of the shares** be based upon a market price if available, or an estimation using an option pricing model.
- Both standards allow the use of **intrinsic value** in situations where a market price is not available. In this case the value is re-measured until the final settlement.
- Both standards define fair value of the transaction as the amount at which the asset or liability could be bought or sold in a **current transaction between willing parties**.
- Both standards define the value of the **defined benefit obligation** as the present value of benefits that have accrued to employees through services rendered to that date based upon actuarial methods of calculation.
- Both standards require **similar disclosures** to provide investors sufficient information to understand the types and extent to which the company has entered into share-based payment transactions.

## Significant differences between standards:

Main Topic	Subtopic	IFRS requirement	U.S. GAAP requirement
Share based payments	Valuation of a transaction with non-employees	Based upon <b>the fair value of the goods or services received</b> , and only on the fair value of the equity instruments in the rare situations when the fair value of the goods and services cannot be reliably estimated.	Based upon the <b>fair value of the goods or services received or the equity instruments</b> used to settle the transaction – <b>whichever is more reliable</b> .
Share based payments	Measurement date for share-based payments to non-employees	The measurement date is the date when the company <b>obtains the goods or the non-employee renders the services</b> . No performance commitment concept is used.	If using the fair value of the equity instrument, measurement is required at the earlier of the <b>date at which commitment of performance by the non-employee is reached or the date at which the non-employee's performance is complete</b> .
Share based payments	Measurement and recognition of awards with graded vesting features	Must recognize compensation cost on an <b>accelerated basis</b> – each individual tranche must be separately measured – necessary to reflect the vesting as it occurs	Company may choose to recognize compensation cost for awards containing only service conditions <b>either on a straight line basis or on an accelerated basis</b> , regardless of whether the fair value of the awards is measured based on the award as a whole or for each individual tranche. If the result is the accelerated basis – this acceleration is based upon the vesting as it occurs.
Share based payments	Recognition of payroll taxes	Generally recognized <b>as the compensation cost is recognized or at the grant date</b> (depending on the terms of the obligation).	Recognition <b>when the obligating event occurs</b> (generally the exercise of an award)
Share based payments	Equity repurchase features based upon <b>employee's</b> choice	Liability classification <b>is required</b> .	Liability classification <b>is not required</b> if employee bears risks and rewards of equity ownership for at least six months from date equity is issued or vests.
Share based payments	Modification of vesting terms that are improbable to achieve	Probability of achieving vesting terms before and after modification is not considered. Instead compensation cost is the <b>grant-date fair value of the original award together with any incremental fair value at the modification date</b> . In other words, the modification results in the <b>recognition of any incremental fair value, but not any reduction in fair value</b> .	If an award is modified such that the service or performance condition, which was previously improbable to achieve, becomes probable to achieve as a result of the modification, the compensation cost is based on the <b>fair value of the modified award at the modification date</b> . Grant date fair value of the original award is not recognized and there is no minimum compensation cost that must be recognized.
Share based payments	Recognition of performance based awards for non-employees	Recognition is based upon the <b>probable outcome of the performance condition</b>	Recognition is based upon the <b>lowest value</b> within a range of possibilities.

<b>Share based payments</b>	Carrying value of liabilities related to goods and services provided by third parties in exchange for share based payment	For cash settled transactions a company recognizes an expense, unless the goods or services received qualify for recognition as assets, and recognizes a corresponding liability. <b>Re-measurements of the liability are recognized in profit and loss.</b>	For cash classified transactions a company recognizes an expense, unless the goods or services received qualify for recognition as assets, and recognizes a corresponding liability. <b>Re-measurements of the liability are recognized as compensation cost that is eligible for capitalization.</b>
<b>Share based payments</b>	Classification of a share based payment transaction settled in redeemable shares	<b>Liability.</b>	<b>Generally</b> classified as <b>liabilities</b> . However, <b>in certain cases</b> , they may also be classified as <b>equity</b> .
<b>Share based payments</b>	Cancellation of a share based payment plan and expense recognition	Cancellation by <b>both the employer and the employee/third party</b> results in <b>acceleration</b> of the unrecognized cost.	Cancellation <b>by the employer</b> results in <b>acceleration</b> of the unrecognized cost. Cancellation <b>by the employee</b> results in continued cost recognition <b>over the remaining service period</b> .
<b>Employee Benefits</b>	Actuarial method for defined benefit plans	The <b>projected unit credit</b> method <b>is required</b> as the actuarial method for the defined benefit plan in all cases.	<b>Different actuarial methods are required</b> dependent on the <b>characteristics of the benefit calculation of the plan</b> .
<b>Employee Benefits</b>	Valuation basis for defined benefit plan assets	<b>Fair value.</b>	"Market related" value, which can be <b>either fair value or a calculated value</b> that smooths the effect of short-term market fluctuations over five years.
<b>Employee Benefits</b>	Carrying value on the balance sheet of the plan asset and liability in the balance sheet	The company must <b>recognize a liability</b> in the balance sheet equal to the present value of the defined benefit obligation plus or minus any actuarial gains and losses not yet recognized, minus unrecognized prior service costs, minus the fair value of any plan assets. Any net asset, after calculation of the above, is subject to a limitation on the amount.	The company recognizes the <b>over/underfunded status as the difference between the fair value of the plan assets and the benefit obligation</b> . Benefit obligation is the pension plan obligation for pension plans and accumulated pension plan obligation for any other postretirement plans.
<b>Employee Benefits</b>	Restrictions on the recognition of post-employment benefit plan assets if plan assets exceed the defined benefit obligation	The net asset <b>recognized cannot exceed</b> the total of unrecognized past service cost and actuarial losses plus the present value of benefits available from refunds or reduction of future contributions to the plan	<b>No limitation</b> on the amount of the net asset that can be recognized.
<b>Employee Benefits</b>	When are actuarial gains and losses recognized in the profit and loss?	<b>As they occur or deferred</b> through a corridor approach applied consistently from period to period. <b>Entities can also choose to recognize immediately in other comprehensive income. Gains or losses immediately recognized in other comprehensive income are not subsequently recognized in the profit and loss.</b>	<b>As they occur or deferred</b> through either a corridor approach or some other reasonable approach applied consistently from period to period.

Employee Benefits	How is expense for past service costs recognized under a defined benefit plan?	Expense for <b>vested</b> past service costs <b>is recognized immediately into profit and loss</b> . Expense for <b>unvested</b> past service costs is <b>recognized into profit and loss over the average remaining vesting period</b> .	Expense for past service costs are recognized <b>initially in other comprehensive income</b> . Both vested and unvested amounts are then <b>amortized into profit or loss over the average remaining service period</b> .
Employee Benefits	How are deferred actuarial gains/losses accounted for inactive employees?	<b>Recognized immediately.</b>	<b>Amortized over the remaining life expectancy of the inactive employees.</b>
Employee Benefits	How are multi-employer benefit plans treated? (1)	<b>Either as a defined contribution or defined benefit plan</b> based on the terms (both contractual and constructive) of the plan.	<b>Similar to a defined contribution plan.</b>
Employee Benefits	Termination benefits	<b>No distinction between onetime termination and post employment benefits.</b> Recognize all termination benefits when the <b>employer is demonstrably committed to pay</b> .	<b>Differences exist between termination and post employment benefits. Special termination benefits</b> are generally recognized when <b>they are communicated to employees</b> unless employees will render service beyond a "minimum retention period" in which case the liability is recognized ratably over the future service period. <b>Contractual termination benefits</b> are recognized <b>when it is probable that employees will be entitled and the amount can be reasonably estimated</b> . <b>Voluntary termination benefits</b> are recognized when the employee accepts the offer.
Employee Benefits	Timing of recognition of gains/losses for curtailment or settlement	<b>Gains or losses from settlements and curtailments</b> are recognized when it <b>occurs</b> (company is demonstrably committed and a curtailment has been announced) This is generally immediately.	<b>Settlement gains or losses</b> are recognized when the obligation <b>is settled</b> . <b>Curtailment losses</b> are recognized when curtailment <b>is probable of occurring</b> and the <b>effects are reasonably estimable</b> . <b>Curtailment gains</b> are recognized when the curtailment <b>occurs</b> (generally when the impacted employees are terminated or the plan amendments are adopted. This could happen after the company is demonstrably committed and a curtailment is announced).

**(1)** A multi-employer benefit plan is a post-employment benefit plan that pools the assets contributed by various entities to provide benefits to employees of more than one company.

**General Impact on Financial Analysis when changing from U.S. GAAP to IFRS:**

The impact on financial statement analysis because of the differences in IFRS and U.S. GAAP regarding share based payments and employee benefits is complicated. This complexity arises for several reasons:

- The accounting principles in both standards are complicated and often require specialist advice to calculate the required values.
- All aspects of the balance sheet can be impacted (assets, liabilities, and equity).
- These differences sometimes result in reclassification for financial reporting purposes of activity between liabilities and equity. This will cause a fundamental change in the structure of a company's balance sheet.
- Some differences might cause further economic consequences for the companies by creating more expense or reported liabilities on a permanent basis.
- Some differences impacting profitability are long term timing differences and do not involve discounting of the expense. Therefore the question arises whether the differences result in de facto permanent changes in the accounting profitability of a company.
- These activities often involve significant values. Therefore, they have a material effect on the financial statements of the company and any associated financial statement analysis.

The general impact on financial statement analysis from these differences is:

- The following differences between IFRS and U.S. GAAP will result in timing differences regarding expense recognition, which will lead to different profit amounts:
  - Share based awards with graded vesting features.
  - Payroll taxes for share based compensation.
  - Performance based share awards for non-employees (probable outcome in IFRS versus the low-est value in U.S. GAAP when a range of equally probable values exists).
  - Carrying value of liabilities related to goods and services provided by third parties in exchange for share based payment.
  - Cancellation of a share based payment plan.
  - Measurement date for share-based payments to non-employees.
  - Recognition of expense for past service costs under a defined benefit plan.
  - Accounting for deferred actuarial gains/losses for inactive employees.
  - Termination benefits.
  - Valuation basis for defined benefit plan assets (fair value always in IFRS versus the possibility in U.S. GAAP to smooth the asset value over a 5 year period).
  - Timing of recognition of gains/losses for curtailment or settlement.

In all of these cases both standards will result in the same total expense recognized over the long term. However, expenses are generally recognized earlier under IFRS than in U.S. GAAP. As a result, the IFRS company will initially appear less profitable than the U.S. GAAP company. Therefore, profitability ratios, earnings coverage ratios, and any other analysis using net income will be negatively impacted for the IFRS company.

These timing differences could last for an extended period such as the average service lives of employees. Therefore a financial analysis needs to consider whether these changes represent a de facto permanent change in the profitability of the company.



- The following differences between IFRS and U.S. GAAP will result in the creation of permanent differences between the accounting results:
  - Multi-employer benefit plans (defined contribution versus defined benefit).
  - Modification of vesting terms that are improbable to achieve (fair value at modification date versus original grant date).
  - Recognition of post-employment benefits assets if plan assets exceed the defined benefit obligation (unlimited recognition in U.S. GAAP versus restricted recognition in IFRS).
  - Valuation of a share based transaction with non-employees for goods or services received (fair value of goods and services versus fair value of equity received).
  - Recognition of actuarial gains and losses in the profit and loss (if a company under IFRS chooses to recognize immediately and only into other comprehensive income).

In these cases the accounting standards result in permanent changes to the financial statements. The impact of these changes depends upon the nature of the change:

- Creation of a new defined benefit plan and the associated future accounting will impact any balance sheet related financial analysis because of the creation of the defined benefit obligation liability and the associated plan assets. Leverage ratios, asset ratios, solvency ratios, and capital structure ratios will be impacted.
  - Generally the IFRS based company will be negatively impacted because of its requirement to report a multi-employer plan as a defined benefit plan.
  - A financial analysis needs to consider whether this accounting change would have a cash flow impact on the company. The change in the accounting principle will not change the terms of the benefit plan and the company's obligations therein.
  - However, presentation of incremental debt on the balance sheet may trigger other consequences that the financial analysis must consider (changes to debt ratings because of higher debt? Lack of compliance with covenants in loan agreements? Possible higher interest rates because of higher reported debt?, and so forth).
- The following differences between IFRS and U.S. GAAP will result in the net changes to the balance sheet through reclassification of liabilities and equity:
  - Equity repurchase features where recognition classification is based upon employee's choice (required as a liability in IFRS; sometimes not required as a liability in U.S. GAAP).
  - Classification of a share based payment transaction settled in redeemable shares (required as a liability in IFRS; sometimes reported as equity in U.S. GAAP).

Generally, the IFRS company will report higher liabilities and lower equity compared to the U.S. GAAP company. As a result, the IFRS based company will be negatively impacted in any financial analysis involving liability values such as solvency ratios, capital structure ratios, and liquidity ratios.

The IFRS company will be positively impacted for any equity-based analysis such as Return on Equity since its equity will be lower.



#### 4) Intangible Assets (Development Costs and Revaluation)

The primary source of IFRS guidance is:

- **IAS 38:** Intangible Assets

The primary source of U.S. GAAP guidance is:

- **ASC 350:** Intangibles – Goodwill and Other
- **ASC 985–20:** Costs of Computer Software to be Sold, Leased, or Marketed

##### Similarities between standards:

- Both standards require that there be probable future economic benefits and the costs that will be included in the asset can be reliably measured before an asset is recognized.
- Both standards disallow capitalization of some types of intangible assets such as startup costs.
- Internally developed intangibles, with the exception of software development costs in certain circumstances, are not recognized as an intangible asset under either standard.
- Internal costs related to the **research** phase of research and development are expensed as incurred under both standards.
- Amortization over the estimated useful life of an intangible asset excluding goodwill is required under both standards with one exception related to assets that are expected to generate net cash flows with no limit in the foreseeable future. In this exception there is no amortization.

## Significant differences between standards:

Main Topic	Subtopic	IFRS requirement	U.S. GAAP requirement
<b>Development costs</b>	Initial valuation	Internal <b>development</b> expenditures are <b>capitalized</b> when technical and economic feasibility of a project can be demonstrated in accordance with specific criteria. Some of the criteria include: intent to complete the asset, and ability to sell the asset in the future. These capitalization criteria are applied to <b>all</b> internally developed intangible assets	Internal <b>development</b> expenditures are <b>expensed</b> as incurred unless there is a separate standard that requires capitalization. Special capitalization criteria apply to software developed for internal use and software developed for sale to third parties. These criteria <b>differ</b> from the general criteria under IFRS.
	Computer software development costs	<b>No separate guidance</b> exists addressing computer software development costs	<b>Separate guidance exists</b> for software development costs. Expenditures related to computer software developed for <b>external use</b> are <b>capitalized once technological feasibility is established</b> in accordance with specific criteria. Expenditures related to software developed for <b>internal use</b> are only <b>capitalized</b> during the <b>application development stage</b> .
<b>Asset revaluation</b>	General principle	Revaluation to fair value of intangible assets other than goodwill <b>is permitted</b> for a class of intangible assets. (1) Revaluation requires reference to an active market for the specific type of intangible.	<b>Not permitted.</b>

**(1)** The incremental carrying amount of an asset that results from a revaluation is recognized in other comprehensive income and accumulated in equity under the heading of revaluation surplus.

An exception to this approach is when an increase reverses a revaluation decrease of the same asset that was previously recognized in profit and loss. In this case the increase is recognized in profit or loss to the extent that it reverses a revaluation decrease of the same asset that was previously recognized in profit or loss.

When the asset's carrying amount is decreased as the result of a revaluation, the decrease is recognized in profit or loss. However, the decrease shall be recognized in other comprehensive income to the extent of any

credit balance existing in the revaluation surplus regarding the asset. The decrease recognized in other comprehensive income reduces the amount accumulated in equity under the heading of revaluation surplus.

When the asset is retired, the revaluation surplus may be transferred directly to retained earnings. This transfer may also occur during the useful life of the asset in a systematic way based upon the difference between the depreciation based on the revalued carrying amount of the asset and the depreciation based on the asset's original cost. Transfer of the surplus to retained earnings through the profit and loss is not performed.

### **Impact on Financial Analysis when changing from U.S. GAAP to IFRS:**

General impact on financial statement analysis from these variances is:

- Development costs capitalization:
  - Profitability under IFRS would be initially improved because of the capitalization of development expenditures. Profitability analysis would be initially positively impacted for the IFRS based company.
  - Asset based analysis for the IFRS company would be impacted since the total asset basis is higher. The impact would depend upon the type of analysis.
  - Liquidity and debt related analysis would not be impacted since this accounting difference impacts the creation of a noncurrent asset and the timing of the expense recognition for the associated cash expenditures.
- Intangible asset revaluation:
  - Intangible asset revaluation is relatively uncommon in practice because it is difficult to find an appropriate reference point in an active market for the specific type of intangible asset.
  - If it did occur, this change would only improve the accounting profitability of the IFRS based company depending upon the specific accounting treatment of the revaluation (was the revaluation recorded to profit and loss or comprehensive income).
  - Any asset or equity based financial analysis would be impacted for the IFRS company since the asset and equity values are increased compared to the U.S. GAAP company.
- The timeframe of the financial statement analysis is important because of the long term nature of intangible assets:
  - The ability to capitalize development costs could result in a longer disconnect in the expense recognition of the company for development expenditures. This disconnect could result in a de facto long term improvement in the company's accounting profitability if the company is in a startup phase or in a period where it is investing heavily in product development. In other words, if actual cash spending on development is higher than the amortization of the resulting intangible development asset, we could say that the profitability for the IFRS based company is "permanently" improved from an accounting perspective through the creation of a growing intangible asset on the balance sheet.
  - Of course, this improvement would not be a cash-based improvement so it would not be sustainable over the long term.
  - Any impact on the analysis would be a timing difference.
  - However this long-term nature of the assets could create a material variance in the timing of expense recognition that could become a de facto improvement in profitability for the IFRS based company. This possibility exists if the timeframe of the financial analysis does not include the complete offsetting expense.
  - So the question for the financial statement analysis is when did the variance arise and when is it offset. A financial statement analysis must identify and, if appropriate, compensate for this situation.

## 5) Leases (Leases of Land and Buildings)

The primary source of IFRS guidance is:

- **IAS 17:** Leases

The primary source of U.S. GAAP guidance is:

- **ASC 840:** Leases

### Similarities between standards:

- Both standards require that the company that bears substantially all the risks and rewards of ownership of the leased property must recognize a lease asset and the corresponding liability.
- The standards for lease accounting are similar except that GAAP has more precisely defined criteria for the recognition of capital leases (called finance leases in IFRS). For example, GAAP states that a capital lease exists if the lease term is equal to or greater than 75% of the asset's economic life. IFRS refers to a "major part" of the asset's economic life. GAAP refers to 90% of the asset's economic fair value whereas IFRS refers to "substantially all" of the fair value.
- Both standards focus on classifying leases as either capital or operating leases.
- Both standards separately discuss lessee and lessor accounting.
- Both standards require that the valuation of the capital (finance) lease asset and liability is done using the lower of the present value of the minimum lease payments or fair value of the asset.

## Significant differences between standards:

Main Topic	Subtopic	IFRS requirement	U.S. GAAP requirement
Leases for land and buildings	Requirement for separate evaluation of land and building to classify a lease	The <b>land and building elements of the lease are considered separately</b> unless the <b>amount that would be initially recognized for the land element is immaterial</b> . In this case the land and building would be treated as a single unit <b>for purposes of lease classification</b> .	The <b>land and building elements of the lease are considered jointly</b> unless the <b>amount that would be initially recognized for the land element is material</b> (above 25% of the total fair value of the leased property). <b>If the fair value of the land at inception represents 25% or more of the total fair value of the lease, the lessee must consider the land and building components separately.</b>  <b>If the lease for land and buildings transfers ownership or contains a bargain purchase option, then the lease is automatically a capital lease</b> regardless of the value of the land and buildings.
Leases for land and buildings	Gain recognition from the sale and leaseback of land and buildings	<b>Immediate gain recognition</b> from the sale and leaseback of an asset <b>is possible</b> if the sales price is reasonable compared to fair value and the lease is classified as an operating lease.	<b>Immediate gain recognition</b> from the sale and leaseback of an asset <b>is generally prohibited</b> unless the leaseback is considered to be "minor."
Leases for land and buildings	Linked contracts	A series of linked transactions in the legal form of an operating lease is accounted for based on the <b>substance of the arrangement</b> ; the substance may be that the series of transactions is not an operating lease.	There is <b>no explicit requirement</b> that a series of linked transactions in the legal form of a lease <b>be accounted for based on the substance</b> of the arrangement.

**Impact on Financial Analysis when changing from GAAP to IFRS:**

The question for the analyst is whether the different standards result in a change in a lease classification from operating to capital (finance). This reclassification would be difficult to determine based upon externally published financial statements since the standards are very similar. The treatment of individual leases would not be visible without access to detailed accounting records. As a result, an external analyst would have to rely on external disclosures from the company regarding any material changes in the financial results that result from the transition to IFRS.

General impact on financial statement analysis from these variances is:

- Reclassification of an operating lease to a capital (finance) lease (example: linked transactions, different classification definitions):

Let us assume that there is a material lease that is classified as a **finance lease under IFRS versus an operating lease under U.S. GAAP**. This change means that:

- The IFRS company will report higher assets, liabilities, asset depreciation and interest expense than the U.S. GAAP company.
- The U.S. GAAP company will report higher operating expense than the IFRS company since all lease payments are recorded in operating expense.
- In this case the different accounting treatment would primarily impact any financial ratios and analysis of the company's asset or liability positions, earnings coverage, and operating income:
  - Leverage, liquidity, capital structure and solvency, and any analysis with assets are impacted negatively for the IFRS company since they contain higher asset and the liability values.
  - Earnings coverage ratios will generally be worse for the IFRS company because reportable interest expense will increase more in percentage terms than the increase in operating income that results because of the conversion of a portion of the operating lease expense to interest expense.
  - Financial ratios using earnings before interest and taxes (EBITDA margin percentage for example) will generally be improved under IFRS since EBIT will be higher than U.S. GAAP EBIT. This positive result occurs because the entire operating cost for the lease is included in operating expense for the U.S. GAAP company. The IFRS company will have a portion of its expense as an interest expense.
- The IFRS possibility to recognize immediately a gain on a sale/leaseback contract that is classified as an operating lease will impact profitability analysis. The IFRS profit will initially be higher than the U.S. GAAP profits.
- The timeframe of the financial statement analysis is important because of the long term nature of the assets that would be put onto the balance sheet because of the IFRS lease accounting requirement:
  - Any impact on the financial statements from a different lease accounting would be a timing difference.
  - However, the long-term nature of the assets could create a material variance in the timing of expense recognition that could become a de facto change for the IFRS based company. This possibility exists if the timeframe of the financial analysis does not include the complete offsetting expense.
  - So the question for the financial statement analysis is when did the variance arise and when is it offset. The analyst must identify and, if appropriate, compensate for this situation.

## 6) Long-lived Assets (Revaluation, Depreciation, and Capitalization of Borrowing Costs)

The primary source of IFRS guidance is:

- **IAS 16:** Property, Plant and Equipment
- **IAS 23:** Borrowing Costs

The primary source of U.S. GAAP guidance is:

- **ASC 360-10:** Property, Plant and Equipment - overall
- **ASC 835-20:** Capitalization of Interest

### Similarities between standards:

- Both standards have a similar definition of a long-lived asset. Long-lived assets are defined as tangible property, plant, and equipment that is expected to be used for more than one reporting period.
- Both standards require that the initial recognition be done at cost.
- Definition of cost is generally the same in both standards: all expenditures directly attributable to bringing the asset to the location and working condition for its intended use. This cost includes expenditures for dismantling and removing the asset and restoring the site where the asset is located.
- Both standards require that costs are included in the value of the asset if the cost can be reliably measured and if future economic benefits are probable.
- Neither standard allows capitalization of startup costs, general and administrative, regular overhead, or maintenance costs.
- Depreciation must be performed on a systematic basis. Any change in depreciation method, residual value, and useful economic life is treated in both standards as a change in accounting estimate requiring prospective treatment.
- Both standards require interest cost directly attributable to the acquisition, construction or production of a qualifying asset to be capitalized. There are differences, however, in the measurement of eligible borrowing costs that will be shown below.

## Significant Differences between standards:

Main Topic	Subtopic	IFRS requirement	U.S. GAAP requirement
Revaluation	When is revaluation permitted	Revaluation <b>is permitted</b> for an entire class of assets if performed on a regular basis. A company must choose the accounting policy for the asset class (cost or revaluation) and apply it consistently to all assets in the asset class. If the company chooses to revalue, the revaluation must be done to fair value. The new carrying value going forward will be the revaluated amount less subsequent accumulated depreciation and impairment losses. (1)	<b>Not permitted.</b>
Revaluation	Residual value	The residual value of the asset is the <b>current net selling pricing</b> assuming the asset was already at the disposal age and in the condition expected at the end of its useful life. (2) <b>Residual value may be adjusted upwards or downwards.</b>	The residual value of the asset is the <b>discounted present value of expected proceeds on the future disposal</b> of the asset.  <b>Residual value may only be adjusted downwards.</b>
Depreciation	Component depreciation	Component depreciation <b>is required</b> if components of an asset have differing patterns of usage and economic value to the company.	Component depreciation <b>is permitted.</b>
Depreciation	Frequency of review of accounting procedures	Estimates of useful life, residual values, and the method of depreciation <b>are reviewed at least at each annual reporting date.</b>	Estimates of useful life, the residual values, and the method of depreciation <b>are reviewed only when events or changes in circumstances indicate that the current estimates and/or depreciation method no longer are appropriate.</b>
Depreciation	Major inspection or overhaul costs	Generally included in the <b>cost of the asset</b> and depreciated over the remaining life of the asset	<b>Choice exists:</b> <b>Expense as incurred,</b> Include in the <b>cost of the asset</b> and depreciate over the remaining life of the asset, or <b>Defer and amortize</b> over the period till the next overhaul date



<b>Capitalization of borrowing costs</b>	Eligible expenditures for capitalization	Eligible borrowing costs include <b>interest, miscellaneous ancillary costs and exchange rate differences</b> from foreign currency borrowings that are regarded as an adjustment of interest.	Eligible borrowing costs include <b>only interest</b> .
<b>Capitalization of borrowing costs</b>	Treatment of investment income	Borrowing costs are <b>offset by investment income</b> earned on those borrowings that are invested short term pending expenditure for the assets.	Borrowing costs <b>are not offset by investment income</b> earned on those borrowings that are invested short term pending expenditure for the assets.
<b>Capitalization of borrowing costs</b>	Expenditures to capitalize when borrowing cost and an asset can be specifically identified	For borrowings associated with a specific qualifying asset, <b>actual borrowing costs</b> are capitalized.	For borrowings associated with specific qualifying assets, <b>borrowing costs equal to the weighted average accumulated expenditures times the borrowing rate</b> are capitalized.

(1) Refer to the IFRS accounting notes in the section regarding intangible assets.

(2) An increase in the residual value is allowed under IFRS. Subsequent depreciation is adjusted accordingly as a change in an accounting estimate. If the residual value of an asset increases to an amount equal to or greater than the asset's carrying amount, then the asset's depreciation charge is zero unless and until its residual value subsequently decreases to an amount below the asset's carrying amount.

### Impact on Financial Analysis when changing from GAAP to IFRS:

General impact on financial statement analysis from these variances is:

- IFRS allows the possibility to capitalize more types of costs compared to U.S. GAAP (borrowing costs, costs for inspection and overall, etc.). This means:
  - The initial asset carrying value of long-lived assets will often be higher under IFRS than U.S. GAAP.
  - Future depreciation expense will therefore be lower under U.S. GAAP versus IFRS.
  - IFRS will result in a higher profit in the beginning for the IFRS company. Thereafter the U.S. GAAP company would show higher profit.

This difference is, of course, a timing difference. Over the complete life of the asset the total expense for the company will be equal.

- However sometimes this difference in the classification of costs will make the IFRS company appear worse in an analysis of operating profit and loss (example: higher depreciation expense in IFRS compared to higher interest related expense in U.S. GAAP). The **U.S. GAAP** expense is reported **in interest expense, foreign exchange losses, etc. (non-core operations for most companies)**, whereas the **IFRS** expense is part of **depreciation (an operating expense)**.

- The **IFRS standard to net investment income against borrowing costs** means:
  - An initial negative accounting profit result for the IFRS company compared to the U.S. GAAP company.
  - This negative impact arises because the investment income is recognized as income immediately in U.S. GAAP and IFRS capitalizes the interest income as part of the cost of the asset.
  - The IFRS company recognizes the positive impact of the investment income through lower future depreciation expense since it is capitalizing a lower amount than the U.S. GAAP company.
  - The IFRS based company will also have better future operating profit results since it will have lower operating costs (lower depreciation expense) than the U.S. GAAP company because the U.S. GAAP company has the profit in interest income (non-core operations).
- Long lived asset revaluation under IFRS would:
  - Improve the profitability of the IFRS based company in some circumstances depending upon the actual accounting of the revaluation (either record revaluation to profit and loss or comprehensive income).
  - Potentially have a material impact on asset and equity based financial analysis if the asset is material such as buildings and land.
- The timeframe of the financial statement analysis is important because of the long term nature of the assets:
  - Any impact on the analysis may be a timing difference.
  - However this long-term nature of the assets could create a material variance in the timing of expense recognition that could become a de facto improvement in profitability for the IFRS based company. This possibility exists if the timeframe of the financial analysis does not include the complete offsetting expense.
  - So the question for the financial statement analysis is when did the variance arise and when is it offset.
  - A financial statement analysis must identify and, if appropriate, compensate for this situation.
- Component depreciation will result in different accounting results between U.S. GAAP and IFRS depending upon multiple factors that are dependent upon the asset and the company policies regarding useful lives. It is difficult, therefore, to generalize about the impact on financial analysis that this accounting change would create.
- The impact of these differences would be difficult to identify unless the financial analyst has access to detailed accounting records beyond the normally published financial statements. You would need, for example, to understand the fixed asset register at the individual asset level to how an asset is capitalized (what was capitalized, what were the components, useful lives, etc.).

## 7) Impairment of Assets (Determination, Calculation and Reversal of Loss)

The primary source of IFRS guidance is:

- **IAS 36:** Impairment of Assets

The primary source of U.S. GAAP guidance is:

- **ASC 350:** Intangibles- Goodwill and Other in the sections regarding impairment or disposal of an intangible asset
- **ASC 360-10:** Property Plant and Equipment in the sections regarding impairment or disposal of long-lived assets

### Similarities between standards:

- Both standards contain similarly defined indicators of impairment for assessing the impairment of long-lived assets.
- Both standards require review of long-lived assets when evidence of impairment exists.
- Both standards require that an impaired asset is written down and an impairment loss is recognized when impairment is identified.

## Significant differences between standards:

Main Topic	Subtopic	IFRS requirement	U.S. GAAP requirement
Determination of asset impairment	Required procedures to determine if asset impairment exists	<b>One-step approach</b> is performed to determine existence of impairment. <b>Impairment testing is performed</b> if evidence of impairment exists.	<b>Two-step approach</b> is performed to determine existence of impairment. <b>First, a recoverability test is performed</b> (carrying amount of the asset is compared to the sum of future undiscounted cash flows generated through the use and eventual sale of the asset). <b>Secondly, if it is determined that the asset value is not recoverable from future cash flows, impairment testing must be performed.</b>
Determination of asset impairment	Level at which impairment analysis is performed	The level at which the impairment evaluation is performed is the <b>cash generating unit (CGU)</b> . This term describes the smallest group of assets that generates <b>cash inflows</b> from continuing use that largely are independent of the <b>cash inflows</b> of other assets or groups thereof.	The level at which the impairment evaluation is performed is the <b>asset group</b> . This term describes the lowest level for which there are identifiable <b>cash flows</b> that largely are independent of the <b>cash flows</b> (rather than cash inflows) of other groups of assets.
Calculation of the asset impairment value	Valuation principle	The impairment value is the difference between the carrying amount of the asset and the <b>recoverable amount</b> . The recoverable amount is the higher of 1) the fair value less costs to sell and 2) the value in use (the present value of future cash flows in use including the residual value).	The impairment value is the difference between the carrying amount of the asset and its <b>fair value</b> (undiscounted cash flows of the asset or asset group).
Calculation of the asset impairment value	Usage of discounted cash flows	The cash flows used to assess recoverability of depreciable and amortizable assets <b>are discounted</b> using a market related rate that reflects the current market assessment of risk specific to the asset at the current date.	The cash flows used to assess recoverability of depreciable and amortizable assets are <b>not discounted</b> .
Calculation of the asset impairment value	Accounting for an impairment loss	An impairment loss on a <b>revalued</b> asset is charged directly <b>to the revaluation reserve in other comprehensive income to the extent that it reverses a previous revaluation surplus related to the same asset</b> . Any excess is re-recognized in profit or loss. (1)	An impairment loss is booked directly <b>to profit and loss</b> . Revaluation upward of assets is not possible.
Reversal of impairment losses	Reversal principle	Long-lived assets must be reviewed annually for evidence of reversal. If appropriate, previous loss <b>may be reversed</b> up to a maximum of the newly estimated recoverable amount or the initial carrying amount adjusted for depreciation. (2)	Loss reversal <b>is not</b> permitted.

**(1)** The recognition of an impairment loss on a non-revalued asset is recorded immediately in profit or loss, unless the asset is carried at revalued amount in accordance with another IFRS standard (IAS 16 for example). In this case the impairment loss on a revalued asset is recognized in other comprehensive income to the extent that the impairment loss does not exceed the amount in the revaluation surplus for that same asset. Such an impairment loss on a revalued asset reduces the revaluation surplus for that asset. Thereafter any excess is recognized in profit and loss.

**(2)** A reversal of an impairment loss for an asset other than goodwill shall be recognized immediately in profit or loss unless the asset is carried at revalued amount in accordance with another IFRS standard (example: IAS 16). Any reversal of an impairment loss of a revalued asset shall be treated as a revaluation increase in accordance with that other IFRS.

A reversal of an impairment loss on a revalued asset is recognized in other comprehensive income and increases the revaluation surplus for that asset. However, to the extent that an impairment loss on the same revalued asset was previously recognized in profit or loss, a reversal of that impairment loss is also recognized in profit or loss.

### **Impact on Financial Analysis when changing from U.S. GAAP to IFRS:**

General impact on financial statement analysis from these variances is:

- The differences between IFRS and U.S. GAAP regarding impairment accounting for long-lived assets will impact the timing and valuation of expense recognition:
  - In general, the likelihood of write downs in IFRS is higher because of the usage of a one step approach to determine if impairment exists (compared to a two step approach in GAAP).
  - The carrying value of assets in IFRS will be lower since the possibility of impairment loss recognition is higher.
- Any financial analysis that includes profit or loss factors (earnings coverage ratios, profitability ratios, etc.) will be initially negatively impacted for the IFRS company. This earlier expense recognition will be a timing difference since the U.S. GAAP results would include the expense at a later date through higher future depreciation or amortization.
- The timeframe of the financial statement analysis is important because of the long term nature of the assets:
  - Any impact on the analysis may be a timing difference.
  - However this long-term nature of the assets could create a material variance in the timing of expense recognition that could become a de facto improvement in profitability for the IFRS based company. This possibility exists if the timeframe of the financial analysis does not include the complete offsetting expense.
  - So the question for the financial statement analysis is when did the variance arise and when is it offset.
  - A financial statement analysis must identify and, if appropriate, compensate for this situation.

## 8) Financial Statement Presentation (Extraordinary Events and Changes in Equity)

The primary source of IFRS guidance is:

- **IAS 1:** Presentation of financial statements
- **IAS 27:** Consolidated and separated financial statements

The primary source of U.S. GAAP guidance is:

- **ASC 205-10:** Presentation of financial statements overall
- **ASC 220:** Comprehensive income
- **ASC 225-20:** Extraordinary and unusual items

### Similarities between standards:

- Both standards require a balance sheet, a profit and loss statement, and information regarding other comprehensive income, cash flows, and associated notes.
- Both require usage of the accrual basis of accounting except in very rare circumstances.
- Both standards have similar concepts regarding materiality and consistency that entities must consider when preparing their financial statements.

### Significant differences between standards:

Main Topic	Subtopic	IFRS requirement	U.S. GAAP requirement
Extraordinary items	Presentation	Separate presentation of extraordinary items in the profit and loss statement <b>is prohibited</b> .	Separate presentation of extraordinary items in the profit and loss statement <b>is permitted</b> for items that are both unusual and infrequent. (1)
Changes in equity	How is comprehensive income reported?	Choose from <b>2</b> alternatives: In a single statement of comprehensive income, or Using a separate profit and loss statement and a separate statement of comprehensive income	Choose from <b>3</b> alternatives: In a single statement of comprehensive income, or Using a separate profit and loss statement together with a statement of comprehensive income, or Within the statement of changes in equity only
Changes in equity	When is a separate statement of comprehensive income required	A company <b>must</b> present a statement of comprehensive income <b>and</b> a statement of equity.	A company is <b>not required</b> to present a separate statement of comprehensive income that is separate from a statement of equity.

**(1)** U.S. GAAP requires presentation of any extraordinary items to be net of income taxes and shown as an adjustment to profit or loss before extraordinary items and the cumulative effect of a change in accounting principle. Net income is calculated after extraordinary items and the cumulative effect of a change in accounting principle.

**Impact on Financial Analysis when changing from U.S. GAAP to IFRS:**

General impact on financial statement analysis from these differences is:

- The differences in IFRS and U.S. GAAP regarding extraordinary items impact the presentation of an extraordinary item in the profit and loss statement. Therefore, this difference will impact any financial analysis that uses profitability measurements other than net income.
  - The IFRS operating expense will be higher than the U.S. GAAP operating expense because U.S. GAAP allows the expense to be reported as an extraordinary item outside of operating expenses whereas IFRS requires reporting as an operating expense.
  - As a result, the IFRS based company will appear worse than the U.S. GAAP company for many profitability ratios such as operating profit margins, EBITDA margins, most earnings coverage ratios, and the leverage ratio “degree of financial leverage.”
- This difference is not a timing or a measurement difference. It is a permanent difference that impacts the profit and loss. Therefore the financial analyst needs to understand and consider adjustment for this change so that any conclusions about the profitability of the IFRS company are not unknowingly misleading.

## **Section B – Planning, Budgeting and Forecasting**

Planning, Budgeting and Forecasting represents 30% of the CMA Part 1 exam. Part 1 is a four-hour exam that will contain 100 multiple-choice questions and 8 to 10 written-response or calculation questions based on two scenarios. Topics within an examination part and the subject areas within topics may be combined in individual questions. Therefore, we cannot predict how many multiple choice questions you may get from this section, nor can we predict whether you will get any essay questions from this section. The best approach to preparing for this exam is to know and understand the concepts well and be ready for anything.

This section focuses on the budgeting process in a business and its inseparable connection with the planning process. You need to understand the benefits of planning, the goals of planning, and the general steps in the planning process. Additionally, you should be familiar with the different types of planning that a business does. Exam questions may address the theories and process of planning and budgeting as well as the different types of planning and budgeting. Top-level planning and the use of pro forma financial statements in the planning process are important topics.

Numerical questions may relate to how much should be budgeted or expected during a period. Questions may also involve a more detailed calculation of the expected cash balance at some period in time, or the cash inflows or outflows during a period. The scope of the numerical questions in planning and budgeting is large, requiring the ability to apply principles and ideas to different situations.

In the area of budgeting, you must understand the budget process and the order in which the different budgets are prepared. You also must be able to make different budgeting calculations. These calculations are not necessarily intuitive when you begin your study process, but after answering some questions and memorizing the required formulas you can expect to feel comfortable with these calculations.

Forecasting techniques, learning curves and other quantitative analysis tools are included because of their usefulness in planning and budgeting. Another topic in this section, top-level planning and analysis, deals with pro forma financial statements and their use in strategic planning.



## Strategic Planning

Planning in general refers to the process that provides guidance and direction regarding what an organization needs to do throughout its operations. It determines the answers to the “who, what, when, where and how” questions of a business operation. Planning is the first activity that management must undertake when creating yearly budgets and making other critical decisions that will affect the future. A company’s plan serves as its guide or compass for the activities and decisions made by individuals throughout the entire organization. The planning process not only defines the company’s objectives and goals, it sets the stage for prioritizing how to develop, communicate and carry out accomplishing them.

Planning is usually not a popular activity. Many people think planning is a waste of time, because it takes time away from day-to-day activities. Other people believe that the environment the company operates in changes too quickly for a plan to be useful, since soon the situation will change, anyway. However, planning is an important management function for several reasons.

The **process** of planning can be as important as the resulting plan, because the process forces management to think about where the company is and where the company wants to be. A plan brings about better coordination of company efforts, since everyone is working toward the same goals. And it provides clear performance standards, enabling better monitoring and control of results. Furthermore, good planning puts the company in a better position to anticipate and respond quickly to sudden changes in its environment. And finally, one of the primary success factors in a company is management’s competence in planning and controlling the firm’s activities. Management’s responsibility is to plan and control the long-range destiny of the company through decisions that either create or seize a positive opportunity, or escape a decline.

### Planning in Order to Achieve Superior Performance

For most companies, if not all, the ultimate objective is to achieve **superior performance** in comparison with the performance of their competitors. When superior performance is achieved, company profitability will increase. When profits are growing, shareholder value will grow. A publicly-owned for-profit company must have maximizing shareholder value as its ultimate goal. The shareholders are the owners. They have provided risk capital with the expectation that the managers will pursue strategies that will give them a good return on their investment. Thus, managers have an obligation to invest company profits in such a way that shareholder value will be maximized.

The result of attaining superior performance will be **competitive advantage**. A company is said to have **competitive advantage** when it is more profitable than the average company in its industry.

Shareholders want to see **profitable growth**: high profitability and also sustainable profit growth. A company with profits but whose profits are not growing will be not be valued as highly by shareholders as a company with profitability **and** profit growth. Attaining and maintaining both short-term profitability and long-term profit growth is one of the greatest challenges facing managers.

**Example:** If a company decreases its Research and Development expenses, its short-term profit will increase as a result of reduced expenses. However, its ability to generate profits in the future may be reduced because it will not have the products it needs to sell.

**Note:** **Shareholder value** is the returns that shareholders earn as a result of having purchased shares in a company. Shareholders’ returns come from both capital appreciation of their shares’ value and from dividends received. **Profitability** and **profit growth** are the primary means by which shareholder value increases.

Strategic leaders are responsible for effectively managing the company’s strategy-making process to increase company performance and maximize shareholder value. The strategies that a company’s management follows will determine the company’s performance in relation to the performance of its competitors.

**Note:** A **strategy** is a set of actions taken by managers of a company to increase the company's performance. The strategy-making process includes both strategy formulation and strategy implementation. Strategy **formulation** is the process of selecting strategies. Strategy **implementation** is the process of putting the selected strategies into action. It involves designing, delivering and supporting products; improving efficiency and effectiveness of operations; and designing the organization structure, control systems, and culture.

In order to increase profitability and sustain profit growth, managers need to **formulate strategies that will give their company a competitive advantage**. This is where strategic planning comes in. The strategies that managers pursue create the activities that together can set the company apart from its competitors and cause it to consistently outperform them.

A company's **business model** is its managers' idea of how the set of strategies and capital investments that the company makes should fit together to generate above-average profitability and, at the same time, profit growth.

A company can outperform its competition even if the company and its competition are all pursuing the same business model. One company may implement the business model more efficiently than its competitors, or its strategies may differ in key areas. The business model along with the strategies that managers select and implement can lead to higher profitability and therefore to competitive advantage, and also to increased profitability. On the other hand, they may not be so successful.

In addition to its business model and strategies, a company's performance is impacted by the competitive conditions in the industry in which it operates. In some industries, demand is growing while in others, demand is shrinking. Some industries might have excess capacity, while others have excess demand. Some industries may be having price wars leading to lower prices because of an excess of supply over demand, while prices in other industries are rising persistently due to an excess of demand over supply. The list of variables goes on and on. Conditions vary from industry to industry. While an individual company cannot change the external variables that affect its industry, it must take them into consideration in its strategic planning process.

Thus, profitability and profit growth for any individual company are determined by two things: (1) its success relative to other firms in its same industry, and (2) the overall performance of the industry it is in compared with that of other industries. Internal factors as well as external factors affect a company's performance.

**Note:** The purpose of strategic planning is to **guide the company** in its efforts to achieve superior performance, competitive advantage, and maximized shareholder value.

Strategic plans are usually for a period of five years or longer. The plan is updated, or **rolled forward**, each year. The results of this annual planning process are usually used, along with tactical and operational planning, in developing the budget for the coming year. In this way, the strategic plan is used to determine resource allocation within the company.

**Note:** Strategic plans are long-term, usually for a period of five years or more.

## The Role of Management in Attaining Profitable Growth

There are two opposing philosophies with respect to the role of management in reaching profit growth:

- 1) The **market theory** gives management a passive role and views its function basically as making reactive decisions in response to environmental events as they occur.
- 2) The **planning and control theory** views the role of management as an active one that emphasizes the planning function of management and its ability to control the activities of the business.

Most companies' managements operate somewhere between these two extremes. At times, events will occur that are outside the control of management and may even be important enough to determine the firm's destiny. But in virtually all situations when non-controllable variables become dominant, a competent

management team can almost always manage and use the situation to move the company to environments where the variables are controllable again.

When management operates more closely to the planning and control theory, it has more ability to reduce the randomness of events and to deal productively with those that do occur.

### Types of Plans and General Principles

In order for plans to be as effective as possible, they must be coordinated among the different units and departments in the company so that they are in alignment with the larger goals of the company. If plans are not coordinated and aligned with the corporate goals, different parts of the company may be working at cross-purposes and the company will not move in a positive direction. Various types of plans are used to match what is being planned with the company's goals.

#### Strategic Plans (Long-Term Plans)

Planning is done initially on a long-term basis. Long-term planning is also called strategic planning. Strategic plans are broad, general, long-term plans (usually five years or longer) and are based on the objectives of the organization. The company's top management does the strategic planning.

**Note:** The longer the time frame of the plan, the higher up in the organization the planning should be done. Similarly, the shorter the time frame of the plan, the lower in the organizational hierarchy the planning should be prepared.

Strategic planning is neither detailed nor focused on specific financial targets, but instead looks at the **strategies, objectives and goals of the company** by examining both the **internal and external factors** affecting the company. Internal factors include current facilities, current products and market share, corporate goals and objectives, long-term targets, technology investment, and anything else within the direct control of the company itself.

External factors also need to be taken into account in strategic planning. Some of the external factors are the economy, labor market, domestic and international competition, environmental issues, technological developments, developing new markets, and political risk in other countries (or the home country).

The process of reviewing the long-term objectives and economic environment of the firm (both internally and externally) will enable the company to identify any threats, opportunities, or limitations that it faces. By identifying threats and limitations early, the company will be better prepared to prevent them from occurring or to limit their effects. By identifying opportunities early, the company is in a better position to act appropriately and capitalize on these situations.

Part of this strategic plan will be a review of the capacity and the capital resources of the company. **Capacity** is the ability of the company to produce its products or services. **Capital resources** are the company's fixed assets. In the long term, the company will need to make certain that its capacity will be able to meet the expected demand and also decide how to obtain this capacity. The firm may either purchase or lease the necessary fixed assets, but a plan is required to determine how the company will obtain the necessary financing for whatever option it chooses. This type of planning is the process of capital budgeting.

By taking all of this information into account, the company is in a position to make **long-term business plans**. These plans may be related to dropping or adding product lines or specific products, or making long-term capital investments in increasing capacity or capital resources, or decreasing capacity or capital resources. It may also generate a plan that will lead the company into a different business model altogether (for example, a shift from production of a product to servicing and supporting the product, leaving production to another company).

**Note:** Strategic planning is **directional, rather than operational**. This means that the company focuses on where it wants to go instead of specifically how it will get there.

### Intermediate and Short-Term Plans

The strategic plan is then broken down into **intermediate** or **tactical plans** (one to five years), which are designed to implement specific parts of the strategic plan. Upper and middle managers develop tactical plans.

**Short-term** or **operational plans** (one week to one year) are developed from the tactical plans. Operational plans focus on implementing the tactical plans to achieve operational goals, and operational plans include budgeted amounts. Operational plans drive the day-to-day operations of the company. Middle and lower-level managers develop operational plans.

As noted earlier, the shorter the time frame, the lower the level of management that should make the plan. Thus, strategic plans are developed by top management, tactical plans are developed by upper and middle managers, and operational plans are developed by middle and lower-level managers. For example, the board of directors should not be involved in developing weekly work plans for an assembly line.

All shorter-term plans need to work toward the strategic plans of the company. If the tactical and operational plans are not working toward that goal, the company will not be able to meet the longer-term, strategic goals that its senior management has developed.

**Short-term or operational plans are the primary basis of budgets.** Operational plans refine the overall objectives from the strategic and tactical plans in order to develop the programs, policies, and performance expectations required to achieve the company's long-term strategic goals.

Most budgets are developed for a period of one year or less. Thus, the budget formulates action steps from the organization's short-term objectives. The budget reflects the company's operating and financing plans for a specific period (generally a year or a quarter or a month). The budget contains the action plans to achieve the short-term objectives.

The one exception to this is the **capital expenditures budget**. The capital expenditures budget is generally developed for a long period of time and the relevant impact is incorporated into the operating and financial budgets each year. The capital expenditures budget needs to be a long-term budget because it may not be possible to quickly increase the capacity of the company. The company needs time to plan for capacity increases.

### Other Types of Plans

Plans may also be **single-purpose plans**, which are developed for a specific item such as construction of a fixed asset, the development of a new product, or the implementation of a new accounting system. These are also incorporated into the operating and financial budgets during the relevant years.

**Standing-purpose plans** have relevance and use for many different items. Plans such as marketing and operation plans fall into this category.

**Contingency planning** is planning that a company develops to prepare for possible future events (especially negative events). This is "what if?" planning. Preparing different plans for different situations is more expensive because it entails developing multiple plans. However, multiple plans for different situations enable the company to be better prepared for what may occur. Companies do this when they think that the contingency planning will eventually lead to greater savings than the cost of the planning itself.

Contingency plans are much more important for companies that are more likely to be significantly influenced by outside events. If there is no plan for a situation in which a negative event occurs, the damage will be much greater to the company because it will not be able to react quickly, and its immediate reaction may not be the correct one. A contingency plan enables companies to respond quickly and in the best possible manner.

**Note:** Despite the benefits of having a formal plan, there are also some drawbacks to this process. A plan that is too formal can constrain creativity, or a strict dedication to the plan can cause the company to miss some opportunities that would be beneficial to them.

Question 53: Which of the following is not a significant reason for planning in an organization?

- a) Promoting coordination among operating units.
- b) Forcing managers to consider expected future trends and conditions.
- c) Developing a basis for controlling operations.
- d) Enabling selection of personnel for open positions.

(CMA Adapted)

Question 54: Certain phases of the planning process should be formalized for all of the following reasons **except**:

- a) Informal plans and goals lack the necessary precision, understanding, and consistency.
- b) Formal plans can act as a constraint on the decision-making freedom of managers and supervisors.
- c) Formalization requires the establishment and observance of deadlines for decision-making and planning.
- d) Formalization provides a logical basis for rational flexibility and planning.

(CMA Adapted)

Question 55: "Strategy" is a broad term that usually means the selection of overall objectives. Strategic analysis ordinarily excludes the:

- a) Trends that will affect the entity's markets.
- b) Target production mix and schedule to be maintained during the year.
- c) Forms of organization structure that would best serve the entity.
- d) Best ways to invest in research, design, production, distribution, marketing, and administrative activities.

(CMA Adapted)

Question 56: Which one of the following management considerations is usually addressed first in strategic planning?

- a) Outsourcing.
- b) Overall objectives of the firm.
- c) Organization structure.
- d) Recent annual budgets.

(CMA Adapted)

## The Strategic Planning Process

The formal strategic planning process consists of five steps. They are:

- 1) Defining the company's mission and addressing the key corporate goals;
- 2) Analyzing the organization's *external* competitive environment in order to identify opportunities and threats;
- 3) Analyzing the *internal* operating environment to identify strengths, weaknesses and limitations of the organization;
- 4) Formulating and selecting strategies that, consistent with the organization's mission and goals, will optimize the organization's strengths and correct its weaknesses and limitations for the purpose of taking advantage of external opportunities while countering external threats (SWOT analysis); and
- 5) Developing and implementing the chosen strategies.

These steps are discussed in detail in the following pages.

### 1) Defining the Company's Mission

**Note:** This is the **first** of the five steps in the strategic planning process.

#### The Mission Statement

The company's **mission statement** provides the context within which its strategies will be formulated. The mission statement includes four components:

- 1) A statement of the company's "**reason to be**."
- 2) Its **vision**, or a statement of a desired future stat.
- 3) A statement of the organization's **values**.
- 4) A statement of its major **goals**.

#### Statement of the Company's "Reason To Be"

In writing the mission statement, management should ask itself, "What is our business? What will it be? What **should** it be?" In answering the questions, they should think in terms of the **customer**:

- What customer **groups** are being served?
- What customer **needs** are being served?
- And by what **means** (skills, knowledge or distinctive competencies) are customers' needs being served?

The answers should be **customer-centered** rather than product-centered. In other words, the company should be in business not to sell widgets, but to satisfy its customers' needs for the benefits that the company can supply through its widgets.

For instance, HOCK is not in business to sell study materials for the CMA exams. Rather, HOCK is in business to help professionals advance in their careers and in their earning capacity by getting certified. This company is **applying a particular skill** (the ability to teach) **in order to satisfy a particular need** (the need to get certified in order to advance professionally) **for a particular group of people** (financial professionals).

Here is another example: Merck & Co., a pharmaceutical company, says in its mission statement, "Our business is preserving and improving human life."

A company's mission statement should be very broad, because customer demands can shift quickly, and a given need can be served in more than one way. A company that limits itself to serving a need in just one

way will find itself obsolete when technological change passes it by. It needs to be flexible and ready to adapt to changing conditions and new ways of serving its customers' needs.

### Statement of the Company's Vision

The next part of the mission statement is the company's **vision**. The vision is what the company would like to achieve, and it should be challenging. A good vision statement should challenge the company by stating an ambitious future state that will (1) motivate employees at all levels and (2) drive the strategies that the company's management will formulate and implement in order to achieve the vision. For example, Du Pont's mission statement says, "Our vision is to be the world's most dynamic science company, creating sustainable solutions essential to a better, safer and healthier life for people everywhere."

### Statement of the Company's Values

After the vision comes the company's **values**, or how managers and employees should behave and do business. A company's values are the foundation of its **organizational culture**. The organizational culture consists of the values, norms and standards that govern how the company's employees work to achieve the company's mission and goals. These standards are in turn associated with the company's performance—either good performance or poor performance. A deep respect for the interests of customers, employees, suppliers and shareholders has been associated with high performance in firms. On the other hand, a lack of respect for the same groups (values **not** expressed in the company's mission statement) has been associated with poor performance in firms. Thus the company must not only "talk the talk" but it must also "walk the walk."

### Statement of the Company's Goals

The final step in the development of a mission statement is the statement of the company's major **goals**.

A goal is a **precise** and **measurable** future state that the company wants to achieve. The purpose of goal-setting is to specify what needs to be done in order to attain the company's mission and vision. Well-constructed goals provide a means for managers' performance to be evaluated.

The characteristics of well-constructed goals are:

- 1) They are **precise** and **measurable**.
- 2) They should be **crucial** and address **important issues**. The number of goals should be limited so managers can maintain their focus on them.
- 3) They should be **challenging** while at the same time being **realistic**. A goal that is too unrealistic may cause employees to either give up or embark upon unethical behavior in an attempt to meet the goal. On the other hand, a goal that is not challenging enough may not be motivating enough.
- 4) They **specify when they should be achieved** in order to create a sense of urgency.

The goals that are developed must be **clearly stated in specific terms**. This prevents "interpretation" of the objectives by employees.

**Example:** A company goal "to become financially stronger" is ambiguous and could lead to different decisions depending on how it is interpreted and how a person understands this as an objective. The goal should be more specific. For example, "reduce debt by \$X" or "increase cash reserves by \$Y" are both specific and not open for interpretation.

Additionally, goals must be **communicated to all individuals who will be impacted by them**.

Finally, for any goal to be effective, individuals within the organization must **accept** the goal. Though it is not possible for everyone in the organization to agree with every goal, it is essential that the goals be clearly understood and communicated, allowing people to address whatever concerns they have about the goals. Whether they agree with them or not, all the employees need to work toward accomplishing the company's goals.



Most companies' **primary goal** is to maximize shareholder returns. Maximizing shareholder returns is accomplished through **high profitability** and **sustained profit growth**. Therefore, most companies' goals include goals for profitability and profit growth. However, pursuit of **current** profits should not be permitted to lead to management actions that will be to the detriment of **long-term** profitability and profit growth. For instance, cutting expenditures for research and development, marketing, and new capital investments will increase short-term profits, but it will do so at the expense of long-term profits. Furthermore, too much pressure to increase current profits can lead managers to take actions that are unethical, such as misrepresenting the true performance of the company to shareholders and others.

### Goals and Objectives

The terms "goals" and "objectives" are often used interchangeably. Furthermore, there is no real agreement on how the two terms differ. Some sources identify a goal as that which is developed and implemented at the unit or department level while an objective is developed at the organizational, or enterprise level. Other sources say just the opposite: an objective is developed at the lower level while a goal is developed at the enterprise level. But both goals and objectives exist at all levels of the organization.

Generally, a corporate goal is a future state that the company wants to achieve. Objectives are the series of steps taken to attain the goal. Objectives are the smaller targets that need to be hit in order to achieve the goal. Units or departments within the organization have goals and objectives they need to meet in order to make their contribution to attaining the corporate goal, and individuals within the organization also have their individual goals and objectives. In all cases, the goals are met through attaining the smaller targets that are the objectives. The goals and objectives of the corporation are met through accomplishment of the goals and objectives of the divisions, and the goals and objectives of the divisions are met through accomplishment of the goals and objectives of the people in the divisions.

Planning is the process that enables a company to achieve its goals and objectives. It is the responsibility of management to make sure that all of the smaller goals and objectives work toward the ultimate achievement of the corporate-level goals and objectives. Management must make certain that this harmonization of goals is done as efficiently and effectively as possible.

**Note:** Because people in each department are most closely connected with the goals of their own departments, there is the risk that the employees will develop **tunnel vision**. Tunnel vision occurs when employees become so concerned with their own goals that they fail to notice or care about the larger goals of the company. If in doing your job you prevent others from doing their jobs, the company not only does not benefit, it can actually be hurt. Managers need to be certain they do not lose sight of the company's goals.

When the goals of one level of the company fit with the goals of the next highest level, the company has achieved a **means-end relationship**. A means-end relationship results when the achievement of the goals of one level enables the next highest level to achieve its goals as well.

Two terms that are related to the accomplishments of goals and objectives are **efficiency** and **effectiveness**. Efficiency is the attempt to fulfill the goals and objectives of the company while using the least amount of inputs. On the other hand, effectiveness has to do with the actual accomplishment of goals. Though both efficiency and effectiveness are important, effectiveness is of ultimate importance. If a company is efficient but does not accomplish what is needed, then the efforts and resources used are wasted.

**Example:** Passing the CMA exam with the minimum passing score is both effective and efficient. Passing with a very high score is effective but not efficient because more time was spent than was required to achieve the goal of passing. Failing the exam by one question is neither effective nor efficient.



## 2) Analyzing the External Environment

**Note:** This is the **second** of the five steps in the strategic planning process.

After defining the company's mission and developing its goals, the first step in developing a strategic plan is to analyze the forces that shape the industry in which the company operates and the competition within that industry in order to understand the **opportunities** available to the firm and any **threats** confronting the firm that can affect it in the pursuit of its mission. Understanding its opportunities and threats will enable the company to outperform the competition.

- **Opportunities** arise when companies can leverage<sup>25</sup> external conditions to develop and implement strategies that will make them more profitable.
- **Threats** include conditions in the external environment that pose a danger to profitability.

Three environments should be examined, and the three environments are interrelated:

- The **industry** in which the company operates,
- The **country** or the **national environment** in which the company operates as **well as the international environment**,
- And the wider environment, or **macroenvironment** in which the company operates.

An **industry** is a group of companies that offer similar products or services to satisfy the same basic needs of their customers. Other companies in the same industry that serve the same basic needs are a company's closest competitors. Identifying the industry the company competes in is the first step in external analysis.

An **industry analysis** involves assessing the company's industry as a whole, the company's competitive position within the industry, and the competitive positions of its major rivals. The nature of the industry, the stage the industry is in, the dynamics and the history are all part of this analysis. For example, the industry the company operates in may be highly competitive, or it may be less competitive. The amount of competition the company faces will impact the prices it can charge, the marketing effort needed, research and development needs, and so forth. Likewise, if the industry is growing, the company can expect and plan to benefit from that growth; or, if the industry is in a decline, the company should plan how it needs to respond.

Analyzing the **national and international environment** includes assessing domestic as well as international political risk and the impact of globalization on competition within the industry. International political risks include the obvious risks of government **expropriation** (government seizure of private property with some minimal compensation offered, generally not an adequate amount) and **war** (which can affect employee safety and create additional costs to ensure employees' safety).

The **macroenvironment** includes macroeconomic factors that will affect the entire industry or the economy as a whole. The most important macroeconomic factors in planning and budgeting are:

- **Economic growth** leads to more consumer spending and gives companies the opportunity to expand their operations and increase their profits. **Economic recession** leads to a reduction in consumer spending and, in a mature industry, may cause price wars. Both will affect demand and thus sales revenue and net income in the future. All companies in the industry will feel the impact of economic growth and economic recession.
- The **level of interest rates** can affect a company's sales and net income if the company is in an industry where demand is affected by interest rates, such as the housing market or the manufacture of capital goods. Rising interest rates will cause demand to decrease, while falling interest rates will cause demand to increase. Interest rates also affect any company's cost of capital and thus its ability to raise capital and invest and expand.

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<sup>25</sup> "Leverage" as it is used here means "to gain advantage through the use of something."

- **Changes in currency exchange rates** affect the competitiveness of companies in international trade. A declining local currency creates opportunities for increased international sales while decreasing foreign competition. An increasing local currency causes the opposite condition.
- Both **inflation and deflation** cause businesses to be less willing to make investments in new projects. When inflation increases, it is difficult to plan on what the real return will be from an investment. Deflation also causes a lack of stability in the economy, because when prices are deflating, companies with a high level of debt and the obligation to make regular fixed payments on the debt can find themselves unable to service that debt. Those companies will be reluctant to commit to new investment projects.

The macroenvironment also includes **social factors** such as environmental issues and government, legal, international, and technological factors that affect the industry and the company. A couple of the many possible examples are:

- The extent to which environmental protection laws are enforced by the Environmental Protection Agency depends to a great degree upon the position of the administration in charge at any given time, since the President of the United States appoints the head of the EPA. The extent to which new laws are passed by Congress and approved by the President depends upon the positions of the parties in power in the two houses of Congress and the position of the administration.
- Current or future anticipated tax credits can affect an entire industry by creating demand, and when the tax credits expire, demand falls. A recent example is tax credits for installation of solar electricity-generating panels. Companies affected included firms that manufacture the materials used by solar panel manufacturers, the manufacturers of the solar panels, and the companies that installed them.

**Note:** The two above examples are based on the situation in the United States. Governmental units similar to the EPA and similar tax issues will exist in other countries.

**Michael Porter**, a leading authority on competitive strategy from Harvard Business School, provided a well-known framework, known as the **five forces model**, that helps managers analyze competitive forces in the environment to identify opportunities and threats.

According to Porter, when one or more of these competitive forces is strong, it creates **limitations** on the company's ability to raise prices and earn greater profits. Thus, a **strong** competitive force depresses profits and so is a **threat**. A **weak** competitive force allows the company to raise prices, thereby improving profits, and so is an **opportunity**. The strength of the five forces can change over time as conditions in the industry change. Managers need to be able to recognize changes in these five forces when they occur and to formulate appropriate strategic responses.

Furthermore, Porter says, it is possible for a company to proactively change the strength of one or more of the five forces through its choice of strategy.

According to Porter, the **five forces** that shape competition within an industry are:

- 1) **The risk of entry by potential competitors.** Potential competitors are companies not presently in an industry but which could enter it. The height of barriers to entry, such as costs or regulatory requirements that make it difficult for new companies to enter an industry, is a major determinant of the risk of entry by potential competitors. Economies of scale constitute a high entry barrier as well, since a new competitor would not have the volume to enable it to compete profitably against the established players in the industry.
- 2) **The intensity of rivalry among established companies within an industry.** Rivalry is the competition among companies in an industry to gain market share from one another. Weapons in the competition include prices, product design, promotional efforts, selling efforts, and service and support after the sale. If rivalry is intense, it leads to lower prices and higher costs, both of which lower profits. Thus, intense rivalry is a strong threat. However, if rivalry is not intense, companies in the

industry can raise prices or reduce their spending on competitive weapons other than price, and industry profits will increase.

The height of exit barriers can influence the intensity of rivalry among established companies within an industry. Exit barriers are factors that prevent companies from leaving an industry. If exit barriers are high, companies may find themselves locked into an industry with declining demand, causing excess capacity which leads to price wars. An example of a high exit barrier is a large investment in assets that are specific to the industry. A company leaving an industry when the industry had overcapacity would not be able to sell its assets or would have to sell them at a very low price resulting in a large loss.

- 3) **The bargaining power of buyers.** If buyers such as large discount store chains have the ability to bargain down prices or to demand better product quality and service that would increase manufacturers' costs, an industry can become less profitable. Therefore, powerful buyers are a threat.
- 4) **The bargaining power of suppliers.** If suppliers have the ability to raise the prices of inputs such as materials or direct labor (through labor unions, for instance) or to lower quality, it will raise the costs of companies in the industry. So powerful suppliers are also a threat.
- 5) **The closeness of substitutes to an industry's products.** The existence of close substitutes for an industry's product is a threat because it limits the prices that can be charged for the product. If there are few or no close substitutes, then companies have the opportunity to raise prices without fear that their customers will switch to a substitute.

### 3) Analyzing the Internal Environment

**Note:** This is the **third** of the five steps in the strategic planning process.

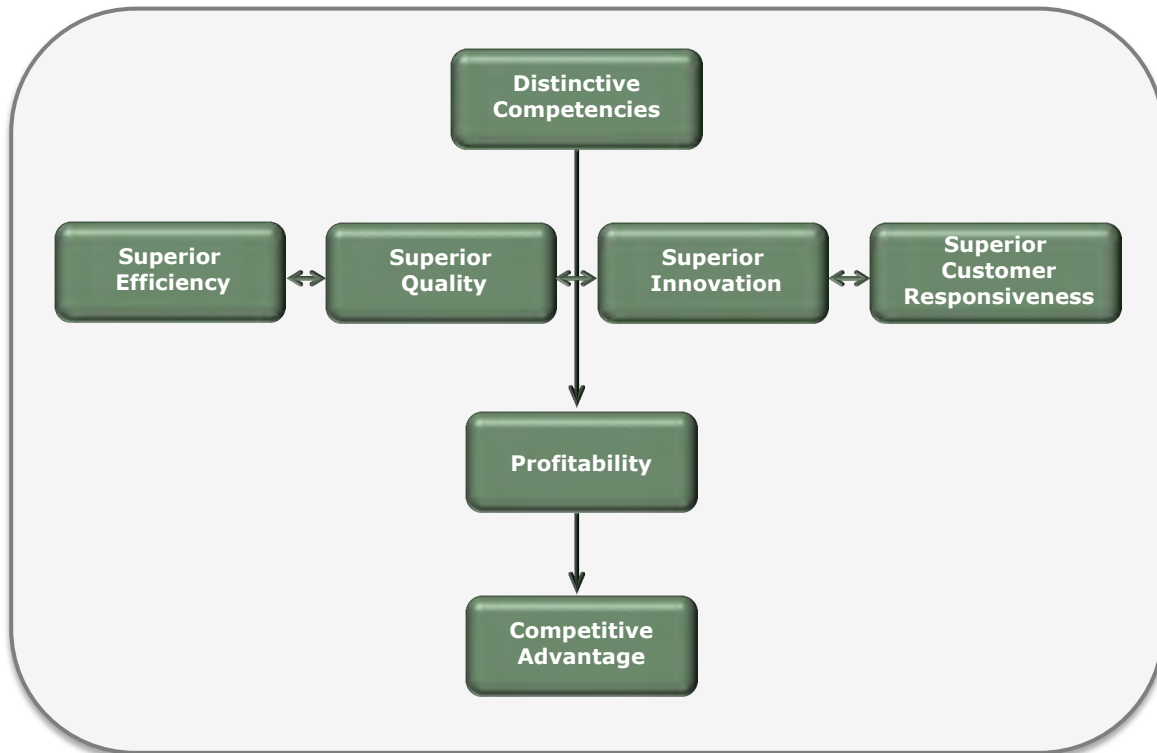
The purpose of internal analysis is to identify **strengths**, **weaknesses** and **limitations** within the organization. The company's resources and capabilities need to be assessed. Strengths lead to superior performance in the areas of **efficiency**, **quality**, **innovation**, and **responsiveness to customers**. Weaknesses and limitations lead to inferior performance.

As we said earlier, a company has **competitive advantage** when it is more profitable than the average company in its industry. It has a **sustained competitive advantage** if it is able to continue having above-average profitability over several years.

**Note:** A **sustained competitive advantage** is the primary objective of strategy.

In order to have a competitive advantage, a company must have or create two basic things:

- 1) Distinctive competencies and the superior efficiency, quality, innovation and customer responsiveness that result from them.
- 2) The profitability that is derived from the value customers place on its products, the price that it charges for its products, and the costs of creating those products.



### Distinctive Competencies

Distinctive competencies are strengths that a company has that enable it to have:

- A **differentiation advantage**, meaning it is able to provide the customer with benefits that exceed those of its competitors, and/or
- A **cost advantage**, meaning it is able to provide to the customer the same benefits as its competitors do, but at a substantially lower cost.

Distinctive competencies stem from two sources: **resources** and **capabilities**.

### Resources

Resources are factors that enable a company to create value for its customers. They can be financial, physical, social/human, technological, or organizational factors. Resources can be **tangible** or **intangible**.

- **Tangible resources** are things such as land, buildings, inventory, and cash.
- **Intangible resources** are nonphysical resources like brand names, company reputation, intellectual property such as patents and trademarks, and employees' knowledge.

As long as a company's distinctive competency leads to a strong demand for the company's products, then that distinctive competency has value. The more difficult a resource is to imitate or replace, the more valuable it is.

For example, if a company has a distinctive competency in a patented product and the patent expires, the value of its distinctive competency will disappear. Or if a superior technology comes along that replaces the company's technology, then its distinctive competency will become far less valuable.

### Capabilities

Capabilities refer to the company's ability to coordinate its resources and to put them to productive use. These capabilities are a function of the way in which management makes decisions and manages its internal rules, routines and procedures to achieve its organizational objectives. A company's capabilities are thus the result of its organizational structure, processes, and control systems. They are intangible, because they are a function of the way individuals within the organization interact, cooperate, and make decisions.

**Note:** A company might have valuable resources, but without the capability to use them effectively, it may not be able to create a distinctive competency.

On the other hand, if a company has capabilities that its competitors do not have, it may not need to have any special resources. If a company has the same resources that its competitors have but it has the ability to manage them more productively than its competitors, it will have a distinctive competency.

Therefore, capabilities are essential for distinctive competency, whereas special resources are not always necessary.

The strategies that a company pursues can **build new resources and capabilities or strengthen existing ones** and thus can enhance the company's distinctive competencies. At the same time, **distinctive competencies shape the strategies** that a company uses, and those strategies in turn lead to a competitive advantage and superior profitability. Therefore, the relationship between a company's distinctive competencies and its strategies is a circular one. Strategies help build and create distinctive competencies, and distinctive competencies in turn shape strategies.

Four factors that derive directly from a company's distinctive competencies create competitive advantage. These four factors are called "generic" distinctive competences, because any company can pursue them. The four factors have already been mentioned, but here we will delve into them more deeply. The four factors are:

- Superior **efficiency**.
- Superior **quality**.
- Superior **innovation**.
- Superior **customer responsiveness**.

**Efficiency** is the relationship between inputs and outputs. Inputs are the factors of production such as land, labor, capital, management and technology. Outputs are the goods and services produced by the company. The more efficient the company, the fewer inputs will be required to produce a given output. The company that can produce the output with the fewest inputs will have the lowest cost structure, other things being equal. Therefore, **superior efficiency leads to lower costs, which in turn lead to higher profitability and competitive advantage**.

The most important components of efficiency are **employee productivity** and **capital productivity**. **Employee productivity** is output per employee; **capital productivity** is output per unit of invested capital. If a company is one for which R&D is important, then productivity of R&D spending, or new products developed from R&D investment, is a major component as well.

**Quality** is a means of differentiating a product from the competition. A product has **superior quality** when customers consider that its attributes give them higher utility than the attributes of competing products. (The concept of "utility" will be discussed in more detail below.) The attributes customers consider important for quality are excellence—design, styling, aesthetic appeal, features, functions, the level of service associated with the product—and reliability. Excellence includes quality materials, fine styling, and so forth. Reliability means that the product consistently does what it was designed to do, does it well, and rarely breaks down.

**Total Quality Management** (discussed in the Business Process Performance section of this textbook) is a response to customers' demands for quality.

Since customers receive more utility from high-quality products, the company can charge a higher price for the higher quality. Another advantage of producing high quality products is the greater efficiency and the lower unit costs associated with them. Less employee time is wasted in producing products that are defective and then fixing the mistakes, so employee productivity is higher. Thus, superior quality not only creates a means for the company to differentiate its product from the competitors' products, but it also lowers its costs. When a company has both lower costs and the ability to charge higher prices than its competitors, it will be more profitable.

**Innovation** is the creation of **new products** or **new processes**. **Product innovation** is development of new or improved products; **process innovation** is the development of a new process for producing and/or delivering products. Product innovation creates value by developing products that customers perceive as having more utility, and thus the company's pricing options for them are increased. Process innovation can create value by decreasing costs.

Innovation in products and processes is perhaps the **most important component of competitive advantage**. Competition is driven by innovations. Product innovations give the innovator something that is unique, and this uniqueness provides differentiation that in turn allows the company to charge a premium price for its product. Process innovation can reduce unit costs below those of the competition.

**Superior responsiveness to customers** comes about because a company has been able to do a better job than its competitors of identifying customer needs and satisfying them. Customers attribute more utility to the product, and this greater utility differentiates the product from that of the competition. Customer response time, or the time required to deliver a product or perform a service, is also an important aspect. These factors also allow a company to differentiate itself from less responsive competitors, build brand loyalty, and charge a premium price.

### Profitability

The other thing that a company must have in order to have a competitive advantage is **profitability** that is derived from the **value** customers place on its products, the **price** that it charges for its products, and the **costs** of creating those products.

The **utility** that customers receive from a product or service, i.e., the satisfaction they gain from it, determines the **value** that they place on the product or service. **This utility is not the same thing as the price of the good or service.** Utility is what customers get from the product or service, not what they pay for it. Utility comes from the attributes of the product, such as the way the product performs, the way it is designed, its quality and service after the sale.

If a company can increase the utility, or value, of its products in the eyes of its customers, it will have more pricing options. It will be able to raise its prices to reflect the increased utility, or it can keep prices low to increase its sales.

**Regardless of what pricing a company chooses, the price the company charges is usually less than the utility (value) that its customers place on the good or service.**

**Note:** The greater the utility that customers receive from a company's products or services, the greater the number of pricing options the company has.

The company is **creating value** for customers when it produces and sells its product or performs and sells its service. This value created is the difference between the utility (U) that the customer gets from the product and the company's costs (C) to produce it.

$$U - C = \text{Created Value}$$

The difference between the customer's utility and the price charged is called **consumer surplus** by economists.

$$U - P = \text{Consumer Surplus}$$

If the company is able to lower its costs, then it can create more value for its customers. Or, alternatively, if the company makes the product or service more valuable through superior design, performance, quality and service, the company is also creating more value for its customers. And when customers assign more value, or utility, to a product or service, they are willing to pay a higher price. Thus, a company has a competitive advantage over its competition if it can create more value for its customers than its competitors are able to.

If a company is going to achieve a sustained competitive advantage and superior profitability, its management needs to make the right choices with respect to utility, by using differentiation and pricing, given the demand in the company's market as well as the company's cost structure at various levels of output.

To accomplish this, the company must look at its **value chain**, which consists of all of its functions — production, marketing, R&D, customer service, information systems, materials management, human resources — to determine each one's role in lowering the cost structure and/or increasing customers' perceived utility through differentiation of its product or service. The **value chain** is composed of **primary activities** and **support activities**. The primary activities such as R&D, production, marketing and customer service relate to the design, creation and delivery of the product. The support activities provide the inputs that allow the primary activities to function. Support activities include materials management, human resources, information systems, and company infrastructure. We will examine the activities in the value chain in detail later on.

A company's **business model** is its managers' idea of how the set of strategies and capital investments that the company makes should fit together to generate above-average profitability and, at the same time, profit growth. Let's look at an example.

**Example:** Two restaurants in the same neighborhood are both serving meals, but they have very different business models. Restaurant A targets the upscale segment, with plush decorating, an extremely competent and solicitous waitstaff, and a high value menu. Restaurant B targets families who want good food at a very reasonable price. Restaurant B is a cafeteria where diners select their own food and carry their food to their tables.

Each restaurant's business model dictates the way each restaurant's value chain will be configured and the investments that will be made to support that configuration. Each restaurant will build the distinctive competencies it needs to accomplish the efficiency, quality, innovation and customer responsiveness needed to support its business model. In doing so, each restaurant can achieve a competitive advantage and generate superior profitability. Their value chain activities and investments will be very different, however.

Restaurant A will invest in decorating and furnishing its premises, in training its staff to provide outstanding service, in buying high quality cuts of meat and the freshest possible vegetables, and in hiring a top chef. Restaurant B will invest more in the physical facilities and the serving staff needed to speed clients through the line and to make sure that adequate seating is available so that everyone will be able to find a table.

For both restaurants, the circular flow of activities will be:

- Each restaurant develops a business model that makes use of its distinctive competencies to differentiate its products and/or lower its costs.
- Each restaurant determines the set of strategies to use to configure its value chain so that it will be able to develop the distinctive competencies that will give it a competitive advantage.
- Each restaurant's distinctive competencies give it the ability to achieve superior efficiency, quality, innovation or customer responsiveness.
- And these distinctive competencies in turn are used to further develop the business model to make better use of the competencies.



### Analyzing Financial Performance

An important part of the internal analysis is analysis of the company's financial performance to identify how its strategies contribute or do not contribute to its profitability. This involves comparing, or **benchmarking**, the company's current financial performance against that of its competitors as well as against the company's own historical performance. Benchmarking using financial statement analysis can help management to understand what is going on in the company and identify its strengths and weaknesses.

By analyzing its financial performance, management can see whether the company is more or less profitable than its competitors and whether its profitability has been improving or deteriorating. It will also help them to see whether the strategies the company is pursuing are maximizing value creation, whether the company's costs are in line with those of their competitors, and whether the company's resources are being used effectively.

Benchmarking will also be discussed in more detail later.

### Durability of Competitive Advantage

Another consideration in internal analysis is how long any competitive advantage that a company has will last, or the **durability** of its competitive advantage. Since other companies are also seeking to develop distinctive competencies, competitors will imitate a successful company. This imitation will limit the successful company's ability to profit from its competitive advantages.

The durability of a company's competitive advantage depends on three factors:

- 1) Barriers to imitation, or factors that make it difficult for a competitor to imitate the company's distinctive competencies, such as patents.
- 2) The capability of competitors to imitate the company's competitive advantage, based upon their **prior strategic commitments** and their **absorptive capacity**.

Competitors' prior strategic commitments are commitments to specific ways of doing business. Once a company makes a strategic commitment, it will be difficult for it to respond to new competition if it would require changing its commitments.

Absorptive capacity means the company's ability to make use of new knowledge.

- 3) The dynamism of the industry environment, or how rapidly the industry is changing. The dynamism of the industry is a part of the external environment. When an industry is changing rapidly, a company with competitive advantage may quickly find its market position overtaken by a competitor with a new innovation.

If barriers to imitation are low, if competitors have the ability to imitate the company's innovations and innovations are being developed all the time, then competitive advantage is likely to be short-lived. And when a company loses its competitive advantage, its profitability falls. In its extreme form, this loss of competitive advantage can lead to complete failure of the company.

Three factors are thought to contribute to failure of a company:

- 1) Inertia, or reluctance to change strategies in order to adapt to changing conditions in the company's competitive environment.
- 2) The company's prior strategic commitments, such as investments, which may limit its ability to imitate rivals and to be flexible, causing a competitive **disadvantage**.
- 3) The **Icarus paradox**. The Icarus paradox is based on a Greek myth. Icarus used a pair of wings that he stuck to his body with wax to escape from an imprisonment. But he flew so well that he flew too close to the sun. The heat of the sun melted the wax holding his wings together. He plunged to his death. This same paradox can be applied to many companies if they become too dazzled by their own success. They believe that the way to attain future success is to follow the same strategies that made them successful in the past. They can become so specialized and inner directed that they lose sight of reality and of what is needed to maintain their competitive advantage.



### The Use of Internal Analysis to Avoid Failure

In order to avoid failure, managers can use several tactics:

- Focus on **all four** generic building blocks of competitive advantage: **superior efficiency, quality, innovation, and responsiveness to customers**. Develop distinctive competencies in those areas that will result in superior performance. Do not become so focused on one of them that the others are neglected.
- Practice **continuous improvement** and **continuous learning**. Things change so quickly that the only way to maintain a competitive advantage over time is to continually improve the four generic building blocks: **efficiency, quality, innovation, and responsiveness to customers**. To do this, it is necessary to focus on **learning** — seeking ways to improve operations and creating new competencies. A company needs to continually analyze the processes that underlie its **efficiency, quality, innovation** and **responsiveness to customers**. It needs to be able to learn from its mistakes and continually seek out ways to improve its processes.
- Identify and adopt best industrial practice through **benchmarking** in order to contribute to superior **efficiency, quality, innovation, and responsiveness to customers**. This is the way a company builds and maintains the resources and capabilities that support **efficiency, quality, innovation, and responsiveness to customers**.
- Overcome the internal forces of inertia within the organization that create barriers to change. Once the barriers to change have been identified, good leadership and appropriate changes in organizational structure and control systems are required in order to implement the changes.

**Note:** The four generic building blocks of competitive advantage are **superior efficiency, superior quality, superior innovation, and superior responsiveness to customers**.

### 4) Formulating Strategies (SWOT Analysis)

**Note:** This is the **fourth** of the five steps in the strategic planning process.

Once the company's external opportunities and threats and internal strengths and weaknesses have been identified, the next step is to perform **SWOT analysis**.

SWOT stands for **S**trengths, **W**eaknesses, **O**pportunities, and **T**hreats. The purpose of SWOT analysis is to optimize the organization's strengths and correct its weaknesses in order to take advantage of external opportunities while countering external threats.

SWOT analysis consists of generating a series of **strategic alternatives** that could be pursued given the company's strengths, weaknesses, opportunities and threats in order to **select the strategies that will do the best to align the company's resources and capabilities to the demands of its environment**.

Management selects a set of strategies that will create and sustain a competitive advantage for the company. They consider a range of strategies. The general classifications of strategies considered are:

- **Functional-level strategy**, for the purpose of improving operations inside the company. These operations include areas such as manufacturing, marketing, materials management, product development, and customer service.
- **Business-level strategy**, which includes the position of the business in the marketplace as well as different positioning strategies that could be used. Some examples are (1) cost leadership, (2) differentiation, (3) focusing on a particular marketing niche or segment, or (4) a combination of more than one of these.
- **Global strategy**, or considering how to expand operations outside the home country.
- **Corporate-level strategy**, considering what business or businesses the company should be in so as to maximize its long-run profitability and profit growth.

The strategies that emerge from SWOT analysis should be compatible with each other. Functional-level strategies should support the company's business-level and global strategies. And corporate-level strategies should also support business-level strategies.

The strategies selected by the company will constitute its **business model**. Remember we have said that a company's business model is its managers' idea of how the set of strategies and capital investments that the company makes should fit together to generate above-average profitability and, at the same time, profit growth.

SWOT analysis enables management to **choose among possible business models** and to **fine-tune the business model selected**.

The four classifications of strategies—functional-level, business-level, global, and corporate-level—are discussed below.

### Functional-Level Strategy

Functional-level strategies are developed to improve the effectiveness of a company's operations. Improved effectiveness of operations improves the company's ability to achieve **superior efficiency, quality, innovation, and customer responsiveness**.

A company's distinctive competencies determine the functional-level strategies that it can pursue. Remember that when companies increase the utility that customers receive from their products through differentiation, while at the same time lowering their costs, it leads to superior profitability and profit growth. And superior profitability and profit growth go along with competitive advantage.

A company's ability to achieve competitive advantage depends upon its ability to attain **superior efficiency, quality, innovation, and customer responsiveness**. Those four generic distinctive competencies will determine whether the company's products and services will be **differentiated** from those of its competitors. They will also determine whether the company will have a **low cost structure**.

Managers can build resources and capabilities that will enhance the company's distinctive competencies by means of their choices with regard to functional-level strategies.

**Superior efficiency** can be increased by:

- Taking advantage of economies of scale and the effect that learning has on efficiency.
- Using flexible manufacturing technologies.
- Reducing customer loss rates.
- Adopting just-in-time inventory systems.
- Designing new products that are easy to manufacture.
- Training employees.
- Utilizing self-managing teams.
- Linking pay to performance.
- Making use of technology such as web-based information systems to reduce the costs of coordination between the company and its suppliers and the company and its customers.
- Building a commitment to efficiency throughout the organization.
- Designing facilities that will foster cooperation among the various functions in order to improve efficiency.

**Superior quality** consists of **reliability** and **excellence**. A reputation for quality gives a company a means to differentiate its products from those of its competitors. Higher quality creates more utility in the opinion of its customers and so gives the company more options with respect to pricing. Furthermore, eliminating defects from the production process lowers the costs for the company and thus increases its profitability.

Improvement of **reliability** can be accomplished through the use of Six Sigma. Six Sigma is a descendant of the Total Quality Management (TQM) techniques that were used by companies during the 1980s and early 1990s. TQM is discussed in more detail later.

Improvement of quality as **excellence** involves improving not only the **product attributes**, but also the **service attributes** and **personnel attributes** associated with the company's product. First, the company needs to identify the attributes that are important to its customers. It then needs to design its products and services to embody those attributes. It also needs to make sure that its personnel are trained so that the correct attributes will be emphasized.

Although the product may have several different attributes that differentiate it, the company cannot cover all of them in its communication messages. To do so would lead to an unfocused message. Therefore, the company needs to decide which of these attributes to promote and how to position them, i.e., how to craft the marketing message so as to create the image the company wants to have in the minds of its customers. The attribute or attributes that the company emphasizes will determine the position the product will occupy in the minds of its customers.

And finally, quality as excellence requires a company to continually improve its product attributes. Therefore, it is important to have a strong R&D department that can work to continually upgrade the attributes designed into the company's products.

**Superior innovation** is in many ways the most important source of competitive advantage. Innovation can result in improvements to the excellence of existing products as well as new products. It can also result in finding ways to reduce costs. Therefore, ability to innovate in order to develop new products and new processes gives a company a major competitive advantage. This allows the company to (1) differentiate its products and charge a premium price, and/or (2) lower its costs below those of its competitors. However, maintaining this competitive advantage requires continuing innovation, because competitors will imitate successful innovations. And only about 10% to 20% of R&D projects actually become commercially successful products. To be successful, a company must be able to coordinate its R&D efforts with the marketing, production, and finance efforts. Top management must be primarily responsible for overseeing the development process.

**Superior responsiveness to customers** means giving customers what they want when they want it and at a price they are willing to pay, and doing it profitably. Responsiveness to customers is an important way for a company to build brand loyalty and thus differentiate itself from its competitors. If a company has strong product differentiation and enjoys strong brand loyalty it will have more pricing options. It can charge a premium price or it can keep its prices low in order to sell more.

The factors of efficiency and quality go along with being responsive to customers. In addition, giving customers what they want includes innovation in the development of new products or new features on existing products.

Thus, superior efficiency, quality and innovation are all part of **superior responsiveness to customers**.

### Business-Level Strategy

Business-level strategy relates to the business's **position** in the market. Successful selection and pursuit of a business model is what permits a company to compete effectively. Business-level strategies that create competitive advantage contribute to a successful business model.

In developing its business model, a company must define its business first. Defining its business includes three sets of decisions. The decisions managers make about these issues determines the strategies they will formulate and implement in order to put the company's business model into action. Those decisions are:

- **Decisions about customers' needs and what needs are to be satisfied.** This decision entails decisions about how much to differentiate their products versus the need to keep their costs down so that the products can be offered at a competitive price. Some companies will choose to **differentiate their products** to a great degree through innovation, excellent quality, or responsiveness to

customers. These managers are investing their resources to create something distinct and different, and as a result they can often charge a premium price. Other managers will base their business model on increasing efficiency and reliability in order to reduce costs. These managers are choosing to offer customers **low-priced products**.

Regardless of what level of differentiation a company chooses for its business model, it will need to recognize that its cost structure will vary as a result of the level of differentiation it chooses. Alternatively, a choice to offer low-priced products will affect the amount of differentiation the company can pursue. **There will always be a trade-off between differentiating products and achieving cost leadership, or having the lowest cost structure.**

- **Decisions about what products should be offered and to which customer groups.** Many different customer groups exist. The company needs to group customers according to their needs in order to determine what products to develop for each different kind of customer. Customer groups that have been identified are treated as **market segments**. The company must then decide whether to offer a product that will satisfy the needs of each identified market segment. The company might choose to offer products targeted at the average customer. If this is their strategy, customer responsiveness is at a minimum and the company is focusing on price, not differentiation. Or, the company might choose to recognize differences among customer groups and offer products targeted toward most of the market segments. For this company, customer responsiveness is high, and the focus is on differentiation, not on price. Or third, the company might decide to target just one or two of the identified market segments and offer products only for customers in these segments. This company is being highly responsive to customer needs in only those segments.
- **Decisions about how customer needs are to be satisfied, using the company's distinctive competencies.** The task is to implement the chosen business model. This involves choosing strategies to create products or services that will provide customers the most value while keeping the cost structure at a level that will permit them to be price competitive. The company's capital is invested in order to shape its distinctive competencies in a way that will result in a competitive advantage based on superior efficiency, quality, innovation, and responsiveness to customers.

A company's choices with respect to its competitive positioning will be affected by the competitive structure of the industry in which it operates. If competitors move into new market segments, the company may need to do the same in order to remain competitive. And because differentiation increases costs, increased industry competition can drive up costs for all companies in the industry. When costs go up, a company's continued profitability will depend upon its ability to charge a premium price to cover its costs.

Therefore, the profitability of a company is dependent upon making the right choices with respect to differentiation, costs and pricing in light of conditions in the company's market and industry. The variables are market demand, competition within the industry (i.e., the five forces model), differentiation, pricing options, and cost structure. As one variable changes, the other variables will change in response to the changes in the first variable. Therefore, managers can never be certain about the outcomes of their decisions.

In order to achieve profitability that is greater than the average in its industry, a company must formulate and implement a business model that will give it a **specific competitive position in relation to its competition**. Four **generic competitive strategies** will give a company competitive advantage. They are called "generic" because any company can pursue them, regardless of what kind of business or industry they are in.

The **four generic competitive strategies** are:

- 1) **Cost leadership**, or having a lower cost structure than all of its competitors. This can permit the cost leader to charge a lower price than the competition, thus attracting more business, and the increased sales will lead to higher profits. Even if its competitors match its lower prices, the cost leader will still have the advantage because its costs will be lower.

The cost leader must choose strategies that will increase its efficiency and lower its cost structure, compared with its competition. It must have distinctive competencies in manufacturing, materials management, and information technology and/or an organizational structure and culture that will allow it to implement this strategy.

The danger in this strategy is that competitors may find ways to lower their cost structures, too. For example, more and more companies are outsourcing manufacturing and other aspects of their business overseas, where costs are much lower. The cost leaders started it, and their competition followed suit in order to remain competitive. Another risk in this strategy is that in their zeal to cut costs, managers might make decisions that cause quality and/or service to suffer. This will lead to customer dissatisfaction and in turn, to decreases in demand and sales. The resulting **decreased** profitability will be the opposite of what the company hoped for, not to mention the long-term damage to the company's reputation and position in the marketplace. For example, Dell announced not too long ago that it was moving some of its technical support functions back to the U.S. from overseas because of customer dissatisfaction.

- 2) **Focused cost leadership**, or competing within a **narrow market segment** using the strategy of cost leadership. A company using focused cost leadership may be a local business reaching a local market. The company competes with the national cost leader only in markets where it does not have a cost disadvantage because of its smaller size. The focused cost leader might concentrate on low volume products for which it has a cost advantage over a national chain because it purchases its materials locally and economies of scale do not exist in that market. An example of a focused cost leader might be a local brickyard, where bricks are manufactured on site and delivered directly to local construction sites. That company might very well have a cost advantage over a brick manufacturer marketing nationally. The national brick manufacturer could have very high costs to transport its bricks to distributors for further sale and delivery to construction sites.
- 3) **Differentiation**, which is based on achieving competitive advantage by providing a product that is different or unique in some important way. It might be **superior innovation, excellent quality, or responsiveness to customer needs**, because those are the three principal ways to achieve product differentiation. A differentiator can charge a higher price than its closest competitors because of its perceived advantages to the customer.

The true differentiator has **no** close competitors, because it strives to differentiate itself from the competition in as many ways as possible. The less its product or service resembles that of its competition, the more protected it will be from competition. A differentiator frequently uses niche marketing — segmenting its markets into niches and providing products specifically for each niche — so that in each of its market niches, it will attract customers who are willing to pay a premium price for something they can get nowhere else.

A differentiated company develops distinctive competencies in whatever functions provide the source of its competitive advantage. For instance, differentiation on the basis of innovation requires an effective R&D function. The differentiator must control its costs so that the price of the product is not greater than its customers will pay, but it must not minimize them so much that it loses its source of differentiation. The danger with a differentiation strategy is that competitors may imitate successful differentiation, eliminating the advantage.

- 4) **Focused differentiation**, or a business model that specializes in serving the needs of just **one or two market segments or niches**. The focused differentiator positions itself to compete with the primary differentiator in the market but in only one or two of the market's segments. To do this, it

focuses on one type of customer, such as babies or elderly people, or on one type of product, such as organic foods. The company can have greater knowledge of the needs of a small group of customers and can provide superior responsiveness to those customers. Or, concentration on just a few products can allow the focuser to be more innovative than a larger company could be.

A focuser limits its market segments because if it is too successful in too many market segments, the primary differentiator in the market will imitate its business model. The primary differentiator would have more resources available than the focused differentiator would have. A company that starts out as a focused differentiator may grow to become the leading differentiator in its industry, however, through expansion.

A focused differentiator can protect its competitive advantage if it can continue to provide a product or a service better than its competitors can. However, its risk is that its niche may disappear over time because of technology changes or changes in customers' tastes. One of the reasons that so many small companies go out of business is that their niche disappears.

A company must continually work to improve its business model by identifying and responding to changing opportunities and threats. Its business-level strategies need to work together and continue to work together if the company is to achieve and maintain competitive advantage. Ensuring that the company is optimally positioned against its competitors is one of management's most important tasks.

### Global Strategy

A multinational company — a company that does business in two or more national markets — faces unique challenges and strategic issues. International expansion can present opportunities for a company to earn higher returns. It can achieve this by using its distinctive competencies in markets where the local competitors do not have those skills, while possibly doing some limited customization for each individual market. Furthermore, the increase in sales volume that results can help a company realize economies of scale and experience learning curve effects, which can lead to a cost advantage.

The multinational company has the opportunity to globalize its production. It can perform each value creation activity in the country where the cost and quality of factors of production (land, labor, capital, energy) are best for that activity. This strategy is called **location economies**. The world economy is also moving toward globalization of markets. National markets are no longer so separated from one another by trade barriers and barriers of distance, time, and culture. Increasingly, national markets are merging into one global marketplace.

Therefore, industry boundaries no longer stop at national borders. Competitors within an industry are located all over the world. Managers can no longer look only at their home markets for competitors. If they do, they could be caught unprepared by the entry of foreign competition. This has intensified competition. National markets that had been dominated by three or four companies are now finding themselves part of global markets where several companies battle for market share in several countries. But while globalization has intensified competition, it has also opened up opportunities for companies to expand globally.

Companies usually choose from four basic strategies in their international operations: (1) **global standardization**, (2) **localization**, (3) **transnational**, and (4) **international**.

**Global standardization** focuses on the cost reductions from economies of scale and location economies. This business model pursues a low-cost strategy on a global scale. In order to keep costs low, the company does not customize its product offerings or marketing strategies to local conditions. Rather, it markets a standardized product worldwide and uses its cost advantage to price the product aggressively in all of its markets. This strategy works if there are strong competitive pressures for cost reduction and the need to be locally responsive to customers is not great.

**Localization** strategy works to increase profitability by offering goods or services that are customized for each different national market. Localization works when consumer tastes vary among nations and when cost pressures are not too intense. The customized products have increased value in the local markets served. However, customization requires smaller production runs and limits the company's ability to benefit from cost



reductions of mass-production. This strategy can work if the added value supports higher pricing and thus enables the company to recoup its higher costs. It also can work if it creates greater local demand, which can allow the company to reduce its costs through economies of scale in its local markets.

**Transnational** strategy can be used when requirements for local responsiveness are high and, at the same time, cost pressures are strong. It is not easy to combine high local responsiveness with low cost structure, and few if any companies have actually been able to accomplish it. One way is to use centralized manufacturing of standard large-scale components and then to augment that with local assembly plants where local product features are added. Thus, the company can achieve many of the scale economies that go along with centralized manufacturing while at the same time providing local responsiveness by differentiating the product for each national market. But it is a challenging task to create an organization that is capable of supporting this type of strategy.

**International** strategy is used by companies that do not have great pressure to produce low-cost goods and do not have great pressure to be locally responsive. This would be the case if the company is selling a product that serves universal needs and if the company does not face significant competition. This is an enviable position to be in. Companies in this position usually centralize their product development while establishing manufacturing or marketing operations in each major geographic area where they do business. They may do some local customization of the product and their marketing strategy, but it is limited. In most international companies, marketing and product strategy are controlled by the home office. However, the risk in international strategy is that eventually, competitors do emerge. Therefore, managers need to be proactive in reducing their costs in order to be prepared. Thus, in the long run an international strategy may not be viable. Companies pursuing it need to move toward a global standardization strategy or even a transnational strategy before the competition catches up to them.

Other decisions that the multinational company needs to make are:

- which international markets to enter,
- when to enter them, and
- on what scale.

In **selecting international markets**, a company needs to balance the benefits, the costs, and the risks associated with doing business in the countries under consideration. The choice should be based on each potential market's long-run profit potential. The long-run benefits are based on factors such as the size of the market, the purchasing power of the consumers in the market, and the probable future wealth of the consumers in the market. Other factors to consider are the suitability of the company's business model to doing business in another country's market as well as the nature of the local competition. If the company can provide a product that satisfies an unmet need in that market, then the value of the product to consumers there will be much greater than if the company offers a product that is identical to what is already available there. With greater value, the company will be able to charge higher prices or build sales volume quickly.

Once a group of national markets is identified, the **timing** of entry must be considered. Entry can be either **early** or **late**. **Early** means entry before other overseas companies get there. **Late** means after other international businesses have established themselves there. There are advantages and disadvantages to both.

Entering early gives the company an opportunity to establish a strong brand name and build up demand and sales volume ahead of any rivals. It also gives the company experience in that market ahead of future competitors. Both of these factors give the company a cost advantage, which can put it in a position to respond to later entrants by cutting prices. In addition, the early entrant can get customers tied into its products or services and create costs to switch that make it difficult for later entrants to succeed. Disadvantages with being the first one to enter a foreign market include **pioneering costs**. A company may have to commit a lot of time and expense to learning how to operate in the foreign country. So an early entrant has a higher probability of failing than does a later entrant. Late entrants can observe and learn from mistakes made by early entrants.

**Scale of entry** is the next decision that the company needs to make. A large scale entry requires commitment of significant resources. It is a **strategic commitment**, because it is a decision with long-term impact that is difficult to reverse. Some companies prefer to enter a foreign market on a small scale and build their business slowly as they become more familiar with the market. A large-scale entrant is more likely to capture first-mover advantages such as economies of scale, switching costs, and preempting demand. However, it is a major commitment, and it is important for the company to carefully consider the implications of a large-scale entry. A small-scale entry may carry fewer risks, but the company can also lose the chance to capture the first-mover advantages.

The next issue the company needs to consider is what will be the best **mode** for the entry. The company has five main options:

- Exporting
- Licensing
- Franchising
- Entering into a joint venture with a host country company
- Setting up a wholly owned subsidiary in the host country

**Exporting** has two primary advantages. First, the costs to establish manufacturing facilities overseas can be avoided. And second, manufacturing product in a centralized location and exporting it can provide scale economies as well as location economies. However, there are also some disadvantages to exporting. First, there may be lower-cost locations abroad where the product could be manufactured at lower cost. So for a company that is pursuing either a global standardization or a transnational strategy, it might be better to do the manufacturing in a country where conditions are more favorable and export from there to the rest of the world. Another disadvantage is that costs to ship internationally can be high. Tariffs can also make exporting uneconomical. Although the tariff is paid by the buyer, not the seller, its effect is to increase the price and thus decrease the demand for the product. And finally, a company that is just beginning to export may delegate the responsibility for marketing in the foreign country to a local agent. If it does this, the agent may not do as good a job as the company would if it were doing its own marketing through a wholly owned subsidiary in the host country.

**Licensing** involves an arrangement with a foreign licensee who buys the right to produce the product in return for the payment of a royalty fee based on the number of units sold. The licensee then invests the capital to get the overseas operation going. An advantage of licensing is that the company does not have to make the investment and bear the risk associated with opening up a foreign market. In a politically risky market, this can be a particularly attractive option. However, licensing has three serious disadvantages. First, the company does not have control over manufacturing, marketing and other strategic functions in the foreign country, since each licensee sets up its own operation. Thus, it is not able to realize economies of scale and location. Second, the company does not receive any profits other than its royalty fee. Thus, it is not able to coordinate strategy across countries, for instance by using profits earned in one country to support operations in another country. Third, there is a risk in licensing technological know-how to foreign companies, because the company loses control over the use of it. The licensee could use the technology to manufacture items under their own brand name and sell them in the U.S. market in direct competition with the company that developed the technology.

**Franchising** is similar to licensing, but it involves longer-term commitments. Furthermore, franchising is a strategy used more by service companies such as fast-food restaurants, whereas licensing is a strategy used primarily by manufacturing companies. In franchising, the franchisor licenses the use of intangible assets such as trademarks to the franchisee and requires the franchisee to follow strict rules in the way it does business. The franchisor may assist the franchisee in running the business. For this, the franchisee usually pays the franchisor an upfront fee plus an ongoing royalty payment of a percentage of its revenues. Advantages of franchising are similar to the advantages of licensing. Using a franchising strategy, a service company can develop a global presence quickly at a low cost. The disadvantages are fewer than in licensing. However, franchising can still prevent the company from achieving global coordination. A second disadvantage is the



lack of quality control over the franchisee's business. The company's brand name is on the product or service, and customers expect the same quality from that franchise as they receive from other franchises. However, the quality may not be delivered, and the franchisor's worldwide reputation can suffer.

**Joint ventures** established with a foreign company in the host country are typically a 50/50 joint venture. Each party has a 50% ownership in the overseas business, and operating control is shared. A 51/49 arrangement is sometimes used, and this allows more control by the company with the 51% stake. Joint ventures have several advantages. One, the company can benefit from the local partner's knowledge of competitive conditions, culture, language, politics, and business systems in the foreign country. Two, the company shares the development cost and risk of opening up the foreign market. And three, in some countries the only feasible entry mode is a joint venture with a local company because of political considerations. U.S. companies may find it much easier to get the necessary government approvals if they are partnered with a local company. Joint ventures can be difficult, though, due to two primary disadvantages:

- 1) A company risks losing control over its technology when it shares it with its foreign partner.
- 2) The company would not have tight control over its subsidiaries and so might not be able to realize scale or location economies.

**Wholly owned subsidiaries** give the parent company all the control, because it owns 100% of the subsidiary's stock. To set up a wholly owned subsidiary, the parent company can either start a new operation, or it can purchase an established company in the country. A wholly owned subsidiary has three advantages. One, having a wholly owned subsidiary limits the risk of the company's losing control of its technology. Two, the company can have tight control over operations. If it needs to take profits from one country to support competitive attacks in another country, it can do that. And three, a wholly owned subsidiary permits the company to realize scale and location economies. However, disadvantages of having wholly owned subsidiaries include the cost and risk of setting up the operations overseas. The parent company bears 100% of these when it has a wholly-owned subsidiary. These risks can be somewhat mitigated if the company buys an established business in the host country and turns it into a wholly owned subsidiary. However, an acquisition can create other problems, such as problems related to cultural differences. These will be discussed later in the section on Developing and Implementing the Chosen Strategies.

The choice of entry mode that a company makes depends upon its situation and its distinctive competencies. For instance, if a company's distinctive competency is mainly in its technology, then it will want to avoid licensing and joint ventures so that it does not lose control of its technological know-how. If the company is a service company, then its competitive advantage will primarily be in its management know-how. Thus, the prospect of the company's losing control over its management know-how is not as serious as losing control over technological knowledge, and franchising or a joint venture might be the best choice. If pressures for cost reduction are strong, the company will probably choose a combination of exporting and wholly owned subsidiaries.

### Corporate-Level Strategy

Corporate-level strategy involves a long-term perspective. Managers need to continually consider how changes that are taking place in an industry, in technology, in customer preferences, and the competition will affect the company's current business model. Focusing on corporate-level strategies can help managers recognize trends and future opportunities, so that they can position their company to compete successfully in the changing environment. Corporate-level managers need to constantly be analyzing how emerging technologies might impact their business models, how customer needs and customer groups might change as a result, and what new distinctive competencies will be needed.

Thus, corporate-level strategy is used to redefine and reposition the company's business model as needed to achieve and maintain its position in the changing environment through taking advantage of opportunities and defending against threats.

Some companies are better off staying in one industry, while others will do better if they enter other industries. Managers use corporate-level strategy to determine which industries the company should enter to

maximize its long-run profitability. The company's corporate-level strategies should support the company's business model so that it can achieve a sustainable competitive advantage at the business level. And having a competitive advantage leads to increased profits.

**Horizontal integration** is a corporate-level strategy that involves acquiring or merging with competitors to achieve competitive advantages such as economies of scale. Mergers and acquisitions can also occur between companies in different countries. Horizontal integration can increase profitability if the integration lowers the cost structure of the resulting company, increases product differentiation, replicates a company's successful business model in new market segments, reduces rivalry in an industry, and increases the company's bargaining power with suppliers and customers. However, there are problems with this strategy. There is significant evidence that most horizontal mergers and acquisitions do not create value for shareholders but, in fact, actually destroy it. In the majority of cases, the resulting company is not more profitable and may even be less profitable than the two separate companies were. Some of the reasons are problems associated with differences in company cultures and management turnover in the acquired company.

**Vertical integration** is used to strengthen a company's business model and improve its competitive position for many of the same reasons that horizontal integration is used. In vertical integration, a company expands its operations either into an industry producing inputs to the company's operations or forward into an industry that uses the company's products. Companies at different stages in the value chain add value at each stage of the process as the product moves from raw materials to the customer. So, for example, if a company's business is the final assembly of purchased parts, backward integration would be merging with or acquiring a company that produces component parts for its final assembly. Vertical integration can increase product differentiation, lower costs, or reduce industry competition if it facilitates investments in specialized assets that enhance efficiency, enhances product quality, and results in improved production scheduling that enables the company to respond more quickly to sudden changes in demand. However, when vertical integration results in an increased cost structure, disadvantages arise when demand is unpredictable. Disadvantages also can develop when technology is changing quickly. When technology is changing quickly, vertical integration can make the company less flexible because it is locked into out-of-date technology if it has acquired a company that produces obsolete components.

**Strategic alliances** are an alternative to vertical integration. They are long-term cooperative relationships between two or more companies to work together to develop a new product that will benefit all of the parties to the strategic alliance. Generally, the companies agree that one will supply the other, and the one doing the purchasing commits to continue purchasing from that supplier. A strategic alliance creates a stable, long-term relationship which lets both companies capture some of the benefits that vertical integration supplies while avoiding the problems of having to manage a merged company.

**Strategic outsourcing** involves the performance of one or more of a company's value-chain activities by an independent specialist company. These independent companies focus on just one activity, and the company can, in turn, focus on fewer value-chain creation activities. Companies often outsource activities where the company does not have a distinctive competency. Because outsourcing companies specialize in a particular activity, they can frequently perform it in a cost-effective way or in a way that will improve the company's differentiation. Outsourcing can help a company lower its costs, better differentiate its product, and focus on its distinctive competencies. A risk of outsourcing is **holdup**, which occurs when the company becomes too dependent on the outsourcer and the outsourcer uses this to increase its prices. Another risk is the loss of valuable information, such as customer complaints when customer service is outsourced.

**Diversification**, or entering one or more new industries to take advantage of the company's distinctive competencies and business model, is another corporate-level strategy. Diversification can be in a **related** industry or in an **unrelated** industry. Companies that remain in one industry may use horizontal integration and strategic outsourcing to strengthen their business models. However, the company's fortunes are tied to the fortunes of its single industry, which can be dangerous if that industry matures and goes into decline.

A company can identify new product opportunities by thinking of the company as a portfolio of distinctive competencies and then considering how to leverage (take advantage of) those distinctive competencies to create more value and profit in the new industry. The new business or product line might be in an industry

that is related to its existing activities because of some kind of attribute shared by the businesses that allows them to create more value by adding the product line.

Some companies, however, have reduced their profitability by diversification. Three things can make diversification unprofitable: **changing conditions, diversification for the wrong reasons, and increasing costs of extensive diversification.**

- **Changing conditions** can be firm-specific or industry-specific. Firm-specific changes can occur when top management of the company changes. The new management may not have the same vision that the former management had or may not have the ability to manage the diversification successfully. The cost structure of the diversified company increases and the gains from diversification are lost. Industry-specific changes include changes in the environment. When changes occur, managers need to be ready to divest businesses if that is the appropriate action.
- **Diversification for the wrong reasons** can destroy shareholder value instead of maximizing it. One reason that has been widely used—but which is a wrong reason—is that unrelated diversification can create a more stable income stream because the different businesses would have different business cycles. Their revenues would rise and fall in different cycles, so one would be rising while another was falling, and they could offset one another.

This justification for diversification fails for two reasons. First, stockholders do not need to hold a stock of a diversified company in order to diversify their own portfolios. Stockholders can easily diversify their own portfolios and at a much lower cost than the company can by simply holding different stocks. Therefore, the attempt to lower risk through diversification is an unproductive use of resources, and profits should instead be returned to the shareholders in the form of increased dividends. And second, it has been determined through research that corporate diversification does not reduce risk because business cycles of different industries are too difficult to predict. A diversified company may find all of its businesses turning down at the same time.

- **Diversification creates bureaucratic costs** because of difficulties between the company's different business units and difficulties between the business units and corporate headquarters. Managerial and functional inefficiencies develop. Costs increase because of the number of business units and the extent to which coordination between and among the different units is necessary in order to realize benefits of diversification. When there are too many individual business units, corporate managers do not have time to understand and assess the business models of all of them. As a result, resource allocation decisions are based on only superficial analyses of each business unit's competitive position. As a consequence, some business units may receive more investment capital than they can profitably invest while other business units with promising business models do not receive enough capital. Further, when business units are sharing resources, it becomes difficult and costly to accurately measure the performance of each unit. Therefore, bureaucratic costs limit the amount of diversification that can be done profitably.

## 5) Developing and Implementing the Chosen Strategies

**Note:** This is the **fifth** of the five steps in the strategic planning process.

Once a set of strategies has been chosen to achieve competitive advantage and increase performance, the strategies must be translated into action. This is strategy implementation. It is taking the actions necessary to execute the strategic plan. Implementing strategy involves decisions about how to use the **organizational structure, corporate culture** and **control environment** to achieve the company's goals and execute its business model. This is **organizational design**.

**Organizational design** involves determining how a company should create, combine and use three elements to pursue its business model successfully. These three elements of organizational design are the company's **organizational structure, control systems** and **culture**. These are the means the organization uses to motivate and coordinate its members to work toward achieving competitive advantage through its distinctive

competencies. Remember that those distinctive competencies are **superior efficiency, superior quality, superior innovation** and **superior responsiveness to customers**.

- **Organizational structure** specifies who should do what, how they should do it, and how they should work together to increase **efficiency, quality, innovation** and **responsiveness to customers**. Specific employees are assigned to specific value creation tasks and other roles. A company's organizational structure coordinates and integrates employee efforts at all levels — corporate, business, and functional. It also coordinates and integrates employee efforts across the company's functions and business units so that they work together to achieve the strategies specified by the business model.
- **Control systems** provide managers with incentives to motivate their employees to work to increase **efficiency, quality, innovation** and **responsiveness to customers**. They also provide feedback to managers on how well the company and its employees are succeeding in increasing these building blocks of competitive advantage. With this information, management can take action when needed to strengthen the business model.
- **Organizational culture** includes all of the norms, values, beliefs and attitudes that people in an organization share. It is the company's way of doing things, and it controls the way its members interact with one another and also with outside stakeholders. Different norms and values are appropriate in different types of organizations, and managers need to be intentional about cultivating and developing the organizational norms and values that are appropriate in their organizations. Furthermore, the structure of an organization affects its culture. In order to change the culture, it may be necessary to change the structure.

**Note:** The three elements of organizational design — organizational structure, control systems and culture — are extremely important factors in a company's success. They determine its members' behaviors, values and attitudes and how the members will implement the organization's business model and strategies.

Analysis of a company's organizational design can lead top management to devise ways to **restructure** the company's organizational structure, control systems and culture in order to improve coordination and motivation among its people. Effective organizational design can give a company the means to obtain competitive advantage and above-average profitability. Therefore, the next priority after formulation of the business model and strategies is organizational design.

### Organizational Structure

The three decisions to be made about organizational structure are:

- How to group tasks into functions, and how to group functions into business units or divisions.
- How to allocate authority and responsibility to the functions and divisions.
- How to increase the coordination or integration between and among functions and divisions, and how to maintain and increase them as the structure evolves.

A **function** is a group of people who work together and who either perform the same types of work or hold similar positions. For example, a group of engineers belong to the engineering function. As organizations grow, peoples' work becomes more specialized. As a result, the amount of work exchanges between and among people, functions and subunits increases. This can become a source of communications problems and managerial inefficiencies, or **bureaucratic costs**. Bureaucratic costs are the costs to manage the exchanges that are required to add value to a product as it flows along the company's value chain. In developing the organizational structure, managers group activities according to function and division in order to achieve the organization's goals effectively.

**Tall versus flat hierarchies** refers to the number of levels of authority in the organization. A **tall** structure has several levels of authority between the lowest-level employees and the top of the organization. A **flat** structure has fewer levels of authority. The taller the hierarchy, the less flexible the organization's structure is

and the more slowly the organization is able to respond to changes in the competitive environment. The **principle of the minimum chain of command** says that a company should have the fewest levels of authority necessary to accomplish its objectives. Elimination of levels of managers has become standard procedure when companies downsize.

**Centralization** of authority means that upper management retains authority to make the important decisions. When decisions are centralized, management can be sure that they will fit the organization's broad objectives. And in periods of crisis, centralization provides strong leadership because authority is centered on one person or group of people. This permits rapid decision making and a coordinated response by the entire organization. Centralized authority usually goes along with a tall hierarchy and creates a less flexible organization. This is because lower levels in the organization have to send information up to top management and wait for management send down the decision.

**Decentralization** of authority means that decision-making authority has been delegated to divisions, functions, and employees further on down the hierarchy in the company. Delegation of day-to-day decisions to middle and lower-level managers gives top management more time to spend on strategic decisions. And when lower-level managers are responsible for implementing strategies, they have more motivation and are more accountable for results. The result is greater flexibility within the organization and more timely decisions. Furthermore, bureaucratic costs can be minimized. And when lower-level employees make more decisions, the company can flatten its hierarchy because fewer managers are needed.

**Integrating mechanisms** are methods of increasing communication and coordination among functions and divisions. There are three basic kinds of integrating mechanisms:

- 1) **Direct contact** among managers. Managers of various functions work together to solve problems. However, functional managers usually have equal authority, and if they disagree on something, there is no means to resolve the conflict other than going to the boss. For this reason, other integrating mechanisms can provide better coordination among functions and divisions.
- 2) **Liaison roles.** One manager in each function or division has responsibility for coordinating with the other. This liaison is part of the manager's job description, and the managers meet on a regular basis to resolve issues. This eases strains among functions and provides a means of communicating information across an organization.
- 3) **Teams.** One manager from each function or division is a member of a team that meets to solve a specific problem. The team members report back to their units on the issues discussed and the recommended solutions.

## Control Systems

Strategic control systems are goal-setting, measurement and feedback systems. They have two functions: (1) to monitor how well the firm is using its resources to build its distinctive competencies and to monitor how well it is performing, and (2) to create incentives to keep its employees focused on the important problems in the organization so they will work together to resolve them.

Therefore, control systems need to be devised to monitor the four distinctive competencies of **efficiency, quality, innovation** and **responsiveness to customers**.

To monitor **efficiency**, managers need systems to measure how many units of inputs are being used to produce one unit of output, and they need to be able to measure the number of outputs they produce. If managers make changes to improve the efficiency of a process, they need measurements to tell them whether they have been successful. Theory of Constraints (TOC) is a means of measuring and improving production, and Activity Based Costing (ABC) is a method of assessing profitability of products. Both of these concepts are discussed later under "Manufacturing Paradigms."

Control systems also need to provide the means to monitor the **quality** of the output. Total Quality Management (TQM) is a method of doing that, and it is also discussed under "Manufacturing Paradigms." In addition, monitoring customer complaints is an important feedback mechanism.

The control system can be designed to encourage risk taking and thus **innovation**. If management creates a culture where employees and middle managers are free to be creative, where authority is decentralized so that employees are empowered to experiment and take risks, innovation will follow. An **adaptive culture** is one that rewards managers and employees for taking initiative. In an adaptive culture, managers can introduce changes to allow the organization to adapt to changes in its external environment. Thus, organizations with adaptive cultures are more likely to survive and thrive in a changing environment than organizations with inert (i.e., not active) cultures.

Control systems can be used to evaluate the company's **responsiveness to customers** by evaluating how well employees with customer contact are doing their jobs. Monitoring of employees' performance will make it possible for managers to help employees improve their performance. The monitoring might reveal a need for additional training of the employees. Or it might reveal a need to find ways to improve processes and procedures that will help the employees do their jobs better. Furthermore, employees who know their performance is being monitored will generally have the incentive to be more helpful to customers.

**Note:** No matter how important planning is to an organization or how developed its methodology, the planning process will never replace the control process. Both are necessary.

### Organizational Culture

Strategic leaders such as the company's founder and top management create the organizational culture and influence the values and norms that develop in an organization. The leadership style established by them influences all of the company's managers, and those managers generally recruit and select others who share their values.

The organization's norms, guidelines and expectations prescribe the appropriate behavior by employees in particular situations. For example, a norm in an organization might be working long hours or communicating almost exclusively by email. Organizational culture acts as a control to influence the values and norms that develop in an organization.

In some organizations, the values of innovation and creativity are highly stressed. Google is an example of an organization in which innovation is a primary value. At Google, employees get one day per week "free" to spend on innovation.

Organizational culture can be affected by organizational structure. The way authority is delegated and the way task relationships are set up can affect the cultural norms and values that develop within the organization. If the senior management of an organization wants to change the organization's cultural values and norms, it needs to look at the organization's structure to see if a change there could contribute to bringing about the desired change in values.

At the same time, organizational culture influences what organizational structure is required. When shared norms and values govern employees' behavior and motivate them, rules and procedures and close supervision become less important.

Three main values are at the heart of an adaptive organization's culture. They have been found to be characteristic of successful organizations, and they contribute to the company's strategy implementation:

- 1) Successful companies have **values that promote action**. They emphasize **autonomy** for their employees as well as for their managers. **Autonomy** is the freedom to make one's own decisions and to take action. There is a culture of entrepreneurship, where employees can feel free to take risks. Employees have a hands-on approach to their jobs. At the same time, managers are not uninvolved. Managers take a hands-on approach, too, and are closely involved in the day-to-day operations of these companies.
- 2) The company's **business model is focused on its mission**. The company sticks with what it is there to do and does not pursue opportunities outside its area of expertise regardless of how attractive they might seem. The company focuses on strengthening its business model. As part of this, the company must emphasize customer-oriented values. It must maintain close relationships with its



customers, because customers know more about the company's performance than the people inside the company can. Furthermore, a company that stays in touch with its customers will be able to learn what their needs are and improve its ability to serve their needs.

- 3) The **organizational design motivates employees to do their best**. Management believes that productivity is achieved through people and that respect for its people is the primary means that it can use to promote their productive behavior. These values lead to a structure where employees have the latitude to think and make decisions, and this motivates them to achieve. The organization is decentralized enough so that employees can participate but also centralized enough so that management can make sure that the company's strategic mission is pursued and its cultural values are followed.

Thus, strategy implementation takes place in the context of the **organization's culture**, its **control systems**, and its **organizational structure**.

The organization's culture can promote an adaptive culture, enabling its employees to achieve its mission. Control systems can further encourage a strong adaptive culture and development of distinctive competencies as well as give employees the incentive to build the company's competitive advantage. And organizational structure contributes to implementation because it provides the framework for tasks. This can reduce transaction difficulties and can give employees the opportunity to create superior performance for the company.

How are specific kinds of organizational structure, control systems, and culture created in order to implement a company's business model?

Remember we said that four specific types of strategies are **functional-level strategy**, which improves operations inside the company such as manufacturing or customer service; **business-level strategy**, which involves positioning strategies such as cost leadership and differentiation; **global strategy**, which is concerned with expanding operations outside the home country; and **corporate-level strategy**, which considers what businesses the company should be in to maximize its long-run profitability. We will discuss implementation of strategies at each of these levels.

**Note:** Implementing strategy involves creating specific kinds of **organizational structure**, **control systems**, and **culture** in order to implement the company's business model.

### Implementing Functional-Level Strategies

The three elements of organizational design — **structure**, **control** and **culture** — help to create distinctive competencies in the implementation of functional-level strategy.

**The role of organizational structure.** Most businesses are organized according to the **functions** performed. Functional structures group people according to common expertise or because they will use the same resources or equipment, and each function concentrates on its specialized tasks. Grouping people together who do similar tasks helps them to learn from one another and monitor one another. It also gives managers more control over organizational activities because it creates several different hierarchies. Thus, the organizational structure is flatter. Managing the business is easier.

**The role of strategic control.** A functional structure makes it easier for managers and employees to monitor and improve operating procedures. Managers can work closely with their subordinates and develop their skills. Output controls are also easier to use when employees are grouped according to function. Measurement criteria can be developed for each function based upon that function's needs. Output controls can give feedback to employees in a function so that they know how they are contributing to the overall performance of the company. **Management by exception**, where managers get involved only when something is not right, can be used along with **management by objectives**, a system where employees set their own goals. Both of these programs can help a company to eliminate some layers of management, because less close supervision of day-to-day activities is required. And when control is increased, the functional structure also

makes it possible for managers to accurately assess the value of each person's individual contribution. Assessing each person's contribution makes possible a reward system that links pay to performance.

**The role of organizational culture.** Functional structures also offer an easy way to build a strong organizational culture. For instance, Total Quality Management (discussed in the topic of *Business Process Improvement* in Section D) involves groups working in teams. Work teams may be given the responsibility of controlling their own members. Work teams frequently develop strong norms and values, and the culture of the group becomes a primary means of control. In R&D departments where highly-educated scientists and engineers may be doing the research, people are also grouped into teams. The group members bring professional norms and values to the situation, which promote coordination and frequently a culture of innovation. In sales and service departments, managers generally spend a lot of time on employee training to instill values relating to customer responsiveness.

Functional strategies must be implemented by using a combination of structure, control and culture so that each function will be able to create the distinctive competencies that will result in superior **efficiency, quality, innovation, and responsiveness to customers.**

### Implementing Business-Level Strategies

Business-level strategies relate to the business's position in the market, and business-level strategies that create competitive advantage contribute to a successful business model. Business positioning strategies that can be used are cost leadership, differentiation, and/or focusing on a particular marketing segment. In order to pursue its business model successfully, the right combination of the elements of organizational design — **structure, control and culture**—is needed.

Specifically, the company needs to find a combination of structure, control and culture that will link and combine its competencies in the value-chain functions. These competencies in the value-chain functions need to be linked and combined in a way that will enhance the company's ability to either differentiate its products or lower its cost structure. To accomplish this linking, it is necessary to coordinate activities across functions and possibly also across business units and/or divisions.

If the company is pursuing a differentiation strategy, its **organizational structure** needs to be designed around the differentiated qualities of the product and the customer groups they serve. When a company is using differentiation, it usually must produce a wide range of products so that it can customize its products to serve its many market segments. A wide range of products makes standardization of activities more difficult, and communications and other strategic problems develop. Managers tend to want to use **control systems** that make use of IT to deal with these problems. However, control systems need to match the organizational structure and focus on the company's distinctive competencies. When there are several different products, people in different functions need to work together. This cooperation, while essential, makes output controls harder to use because it is difficult to measure the performance of people from different functions who are all cooperating together. Therefore, a differentiator needs to rely more on **cultural** means—behavior controls through shared norms and values. For that reason, companies pursuing differentiation frequently have a very different kind of culture from those that pursue cost leadership. The cultures of companies pursuing differentiation are based on professionalism and collegiality with emphasis on the distinctiveness of the individual rather than the pressure of the bottom line.

Differentiators that produce many different products for many different market segments frequently use **product structure** instead of functional structure in order to solve the control problems. The product line is broken up into several smaller subunits. Each product group has its own management and focuses on the needs of a particular customer group. Value-chain support functions such as R&D, marketing and finance are centralized. The support functions are organized according to product-oriented teams, with each team specializing in the needs of a particular product group. The various teams within each support function all share knowledge and information with each other, permitting the use of control systems that can monitor the performance of each product group individually. Senior managers can intervene if the control systems point out a problem, and the reward system can be more closely linked to performance.



Some companies use a **market structure** that is similar to the product structure, except it focuses on customer groups instead of product groups. People are grouped by customer or market segments. A company that is pursuing a strategy that is based on improving its responsiveness to customers would use a market structure.

A company that is expanding nationally or internationally may use a **geographic structure** where geographic regions are used for grouping activities. Large apparel retailers with stores in many communities commonly use a geographic structure. Use of a geographic structure enables stores in different geographical areas to carry clothing appropriate to each one's region—for example, heavy winter outerwear in cold climates and lighter-weight outerwear in warmer climates. As in a product and market structure, support functions remain centralized so that their skills are available to all the regions.

**Matrix structures** have developed recently to improve organizations' ability to respond quickly to changes in technology or industries. In matrix structures, value-chain activities are grouped vertically by function and horizontally by product or project. Employees in a matrix work in teams and have two supervisors, one the head of their function and one the head of the product(s) or project(s) they are working on at any given time.

Matrix structures promote innovation and speed up product development because the structure promotes cross-functional communication. Matrix structures are most appropriate in high-technology companies where R&D is primary. The matrix structure requires less direct employee supervision than other structures. Employees in these types of companies are generally highly qualified and prefer to work in an autonomous, flexible environment. If the matrix structure is to work effectively, the employees must have norms and values that include innovation and excellence.

Conflicts can arise because of employees' having two supervisors. In addition, it is difficult to monitor and evaluate individuals when they are working on various teams. Coordinating task activities can be a problem. Therefore, it is necessary to have a strong culture and common norms and values. Reward systems should be based on group and organization performance rather than individual performance.

**Product-team structures** have advantages similar to matrix structures, but they are easier and less costly to administer. People are organized into permanent cross-functional teams, rather than in changing teams as in a matrix structure. Each specialist is part of a permanent cross-functional team that focuses on a range of products. The support service personnel are part of each permanent team, rather than being centralized.

Strategic managers need to be continually monitoring the company's ability to increase differentiation, lower costs, and increase profitability. To increase their company's performance or to prevent its decline, they must be able to use **organizational design** and its components—structure, control and culture—to quickly change the way people and their work are organized and controlled when the situation calls for it. Sometimes that means **restructuring** and downsizing the organization to improve its performance.

**Restructuring** a company usually involves (1) streamlining its hierarchy of authority and reducing the levels in the hierarchy, and (2) reducing the number of employees. Sometimes restructuring is done because of a change in the business environment, such as a change in technology. Sometimes it is done to maintain competitive position. Other times, though, restructuring is needed because the company has not monitored and controlled its business properly and has not made periodic small changes that would have allowed it to adjust slowly to changing conditions.

Another way to improve performance is to use **business process reengineering**. Business process reengineering is discussed in the *Business Process Improvement* section.

### Implementing Global Strategies

Structure is very important in implementing global strategies. As discussed previously, the four basic strategies used by companies in international operations are localization, international, global standardization, and transnational.

Different structures, control systems and cultures are required for each of these strategies. In general, these systems need to be less complex when a localization strategy is pursued. They need to be more complex for

an international strategy, even more complex for a global standardization strategy, and the most complex for a transnational strategy.

The organizational structures used for each strategy are:

- **Localization** is oriented toward responsiveness to the local markets. Control is decentralized so that each subsidiary in each country or region can produce and customize products to the local markets. This is called a **global-area** structure, and managers in each country or region make decisions as to the appropriate strategies.
- **International** generally combines centralized R&D and manufacturing with decentralized marketing in each major geographic area where they do business. This is a **global-division** structure. Global operations are managed as separate divisional businesses, but managers of international operations are under the control of the company's global division.
- **Global standardization** is a low-cost strategy. The company offers standardized products world-wide and works to keep cost down. Principal value-creation activities are centralized at whatever is the best global location for them. This structure is called a **global product-group structure**. A product-group headquarters coordinates the activities of both home and overseas operations and its managers decide where to locate the different functions.
- **Transnational** attempts to achieve both local responsiveness and cost reductions. Basic value-adding functions are centralized while local product features are added at local assembly plants. A **global-matrix** structure is used.

The controls used with each strategy are:

- With a **localization** strategy, managers at global headquarters use market and output controls. These could be things such as return on invested capital, growth in market share and operating costs to evaluate the performance of the foreign division. The results are used to make capital-allocation decisions.
- When the company uses an **international** strategy, the company usually adds a foreign sales organization to its existing structure and uses the same control system for it as it uses for its other business units. If the company is using a functional structure, the global division headquarters office coordinates the manufacturing, sales and R&D activities with needs of the foreign market. Behavior controls are used to keep the home office informed as to sales and other metrics.
- When a **global standardization** strategy is used, control is centralized in order to reduce costs.
- The **transnational** strategy is the most complex. Regional or country managers control local operations, but they report to managers in product-group headquarters. A system of output and behavior controls is used. The regional managers work with U.S. product-group managers to develop reward systems.

### Implementing Corporate-Level Strategies

Corporate-level strategies are used to determine what industries a company should enter to support its business model and maximize its long-term profitability. Corporate level strategies include entering a new industry, joint ventures, and mergers and acquisitions. The organizational design elements of structure, control and culture can be used to improve the success of these strategies.

The best way for a company to **enter a new industry** is for the managers to treat the process as a form of entrepreneurship. The people who lead these new ventures are known as **intrapreneurs**, or internal entrepreneurs. The organizational structure, control and culture must encourage creativity and provide the managers with autonomy and the freedom to develop new products. The managers will need to make sure that the new product will be profitable and that there is a "fit" between the new industry and the old one.

It is important to be able to coordinate efforts across functions in order to develop new products quickly. To accomplish this, a cross-functional team structure can be used. A team leader can be responsible for building team relationships and developing a team culture. A company norm such as Google's, where everyone spends

one day a week on innovation, can act as a control. In addition, product innovators can be given bonuses and rewards for the launch of successful new products. Such activities develop norms and values that support sharing of information among people in different functions. The structure and control systems can create a culture where it is better to take a risk than it is to do nothing.

Alternatively, a company can segregate the new product development function from the day-to-day activity of the organization by setting up a separate new venture division. A separate division can give the new product team more freedom to pursue new product ideas, because they are separated from day-to-day activities. The new venture division can use stock options to reinforce the entrepreneurial culture. Output controls would not be appropriate.

Two companies might establish a **joint venture** and collaborate on a new business to compete in a new market. The two companies might pool resources and capabilities in order to create more value for both of them. Managers from both companies oversee the venture. The companies might establish a separate company and share ownership, or they might not set up a separate entity. If they set up a new company, each participating company transfers to the new company the resources and capabilities they have agreed upon. Issues to be dealt with include how the venture is to be structured and controlled, and how differences between the cultures of the companies involved are to be managed.

The companies need to allocate authority and responsibility, as well as ownership. The venture could be structured for the two companies to share ownership 50-50, or one might hold a controlling interest. They both need to be able to monitor the venture's progress. Officers need to be appointed and those officers need to develop the business model and decide upon the organizational structure for the new company. They also will need to build a company culture that can unite the members from two different cultures.

**Mergers and acquisitions** also present structure, control and culture challenges. Many acquisitions do not succeed because the management fails to anticipate the challenges associated with merging. Structural challenges include how to establish new lines of authority and responsibility that will permit them to leverage both companies' competencies. Infighting can keep any benefits from the merger from ever being realized. One of the goals needs to be to prevent skilled managers from leaving because they feel they have been demoted.

If the acquiring company has an adequate control system, the new company can be included in it so that monitoring of activities is standardized. Alternatively, the best elements of both companies' control systems can be combined.

Furthermore, the acquiring company must realize that its acquired company has a unique culture, and it needs to understand that culture if it is to manage the merged company effectively.

Some companies minimize these difficulties by entering into an alliance or a joint venture of some kind with the prospective merger candidate. Their people spend a year or two working side by side with the prospect's people. They may buy enough of the company's stock to obtain a seat on its board of directors, and from there they can do much better due diligence. They become very familiar with the company's financial performance, and they know if the company is under some kind of pressure to sell. Many times, by the time they are ready to consider purchasing the remainder of the company, they already know where within its organization the other company's managers will fit in, minimizing culture clash. Mergers and acquisitions entered into this way have a much higher success rate than others.

Question 57: Which of the following should not be included in a company's internal analysis process?

- a) Issues relating to creating value for the company's customers.
- b) Understanding the company's capacity for innovation.
- c) Evaluation of environmental issues that may affect the company's profitability.
- d) Weak areas within the internal organization that should be improved.

(HOCK)

## Other Planning Tools and Techniques

### Situation Analysis and PEST Analysis

**Situation analysis** is the systematic collection and evaluation of external and internal forces that can affect the organization's performance and choice of strategies and assessing the organization's current and future strengths, weaknesses, opportunities and strengths. Steps 2, 3 and 4 of the strategic planning process outlined in this book—analyzing the organization's external and internal environment and formulating and selecting strategies to optimize the organization's strengths and correct for its weaknesses and limitations to take advantage of opportunities while countering threats (SWOT analysis)—is a type of situation analysis.

PEST analysis is another type of situation analysis. "PEST" stands for **P**olitical, **E**conomic, **S**ocial, and **T**echnological factors that are examined in the process of doing strategic planning for an organization.

**Political** factors involve the way a government of a country behaves. Political factors are outside the control of a business, so the business must understand how political changes can affect it. Some political factors that should be considered are:

- Trade regulations, pricing regulations, and tariffs.
- Wage legislation, such as minimum wage requirements.
- Political stability or instability of the country, because when a country is politically unstable, its citizens' spending habits change.
- Product labeling requirements that must be adhered to.
- Industrial health and safety regulations.

**Economic** factors include exchange rates, inflation rates, interest rates and economic growth or contraction and the effects they can have on a business. Analyzing the economic factors can help a business forecast demand and costs. Other examples of economic factors that should be considered are:

- The skill levels of the workforce and the cost of labor.
- The unemployment rate within the market, because if unemployment is high, demand will be depressed.
- The business cycle stage the country is in, since that also determines how great the demand will be,
- The economic system in the countries where the business operates.
- Any intervention by the government in the market.

**Social** factors refer to the culture in a country, its population growth rate, the average of the population and the attitudes of its citizens toward things such as health and careers. Social trends can have a great effect on demand for a business's products and services. Other social considerations include:

- Demographics can be used to see where in the country people live and work.
- Education level, as education plays a major role in what kind of work people do and how much disposable income they have.
- Attitudes of the population toward the environment.
- Leisure interests of the population.

**Technological** factors help a business determine what technology to focus on in the future:

- New developments in technology affect how the business operates on a day-to-day basis and how it delivers its services and interacts with its customers and suppliers.
- Technology can impact the structure of the company's value chain.
- Technology can affect the cost structure of the business. Technological advancements can help a business reduce its costs and become more profitable.<sup>26</sup>

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<sup>26</sup> Source: [www.pestanalysis.net](http://www.pestanalysis.net). Accessed June 14, 2014.

### Competitive Analysis

Competitive analysis is also similar to SWOT analysis in some ways. It involves analyzing the competitive environment in which a business operates or is considering operating in to determine the following:

- Strengths and weaknesses of competitors.
- Demographics and needs of the market in which the business operates.
- Strategies to improve the company's position in the marketplace.
- Impediments to the company's entering new markets.
- Barriers the company can erect to limit competitors' ability to erode the company's place in the market.

Competitive analysis includes:

- Defining the competitors.
- Analyzing the competitors' strengths and weaknesses.
- Analyzing the company's own internal strengths and weaknesses.
- Analyzing customer needs and wants,
- Studying impediments to the market for both the company and its competitors, such as patents, high start-up costs, or a high level of knowledge required for success, and
- Developing a strategic plan that reflects the findings from the above activities.<sup>27</sup>

### Contingency Planning and Scenario Planning

Contingency planning is planning that a company develops to prepare for possible events. In a way it is "what if" planning. This widely-used approach is also called "scenario planning" and, as its name implies, involves considering alternatives that enable an organization to respond quickly to **future events, generally external**, that are often unpredictable.

External events, called **external contingencies**, are factors that are not within the control of the organization but that influence the strategic planning process. External contingencies include changes in the competitive environment, changing government regulations, political issues, changing demographic trends, advances in technology, and changes in the physical environment.

**Internal contingencies** may also affect the strategic plan, although internal contingencies are usually within the control of the organization. Internal contingencies include changes in the mission of the organization, changes in organizational objectives, changes in organizational culture, and organizational design issues.

Contingency planning involves developing two or more plans, each based on a different set of strategic and operating conditions. Then, the plan that is implemented is the one for the specific circumstances that actually occur. When a plan is already in place for a potential negative event or threat, the company can quickly implement an appropriate alternative to waylay or diminish the damage.

Contingency plans are especially critical for companies that are likely to be significantly influenced by external events. A contingency plan enables companies to respond quickly and in the best possible manner when changes in external factors might adversely impact strategic plans.

Preparing different plans for different situations is more expensive because it entails developing multiple plans. Companies undertake this approach when they think that the cost of contingency planning will eventually lead to greater savings than the cost of the planning itself.

Contingency planning is an approach that organizations often use in financial planning and analysis because it considers several alternative possibilities, specifically those concerning external variables.

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<sup>27</sup> Source: <http://www.referenceforbusiness.com/small/Bo-Co/Competitive-Analysis.html>. Accessed June 14, 2014.

Question 58: Contingency planning is a process that companies undertake to:

- Make certain that their capacity will be able to meet the expected demand as well as decide how to obtain this capacity.
- Determine how to obtain the necessary financing for the future.
- Understand how customer expectations have changed.
- Prepare for future, external events.

(HOCK)

### The BCG Growth-Share Matrix

The **BCG Growth-Share Matrix** is a method of analyzing a company's portfolio of products to determine where each product is in its life cycle. It was developed by the Boston Consulting Group in the 1970s to assist corporations in analyzing the life cycles of their product lines in order to make better decisions about allocation of resources in planning.

The BCG Matrix classifies products into four categories based on the growth of the markets they are in and their share of those markets. The matrix is a square with four quadrants. Market growth rate is along the side and relative market share is along the top. A product's position on the relative market share scale (high or low) indicates its cash generation capability and its position on the market growth rate scale (high or low) indicates its need for cash for investment.



A **star** is in an industry that has a high market growth rate, and the product has a high share of the market. A star generates a lot of cash because it has a high share of its market. However, because the market is growing rapidly, the star's sales are also growing rapidly. Rapidly-growing sales create a need for working capital to support the required increases in accounts receivable and inventory. As a result, a star has a high need for cash for investment. Therefore, the net amount of cash a star generates is not great. If a star can maintain a high market share, the star will become a **cash cow** when the market's growth rate declines, generating more cash than it consumes. Stars are important because they ensure future cash generation. The

company may adjust the price of a star several times, decreasing it to claim market share and then increasing the price to maximize revenue as the product's market share and popularity grow.

A **question mark** is a product in an industry with a high market growth rate, but the product has a low share of the market. Because the market is growing rapidly, the question mark's sales are also growing rapidly, so it will consume a lot of cash for investment. However, because of its low market share, it does not generate much cash. A question mark has potential to gain market share and become a **star** and then eventually a **cash cow** when the growth rate of the market slows. But for the present, a question mark is considered a "problem child" because its net cash generated is negative. Furthermore, if the question mark does not attain a greater share of its market, it will turn into a **dog** when the growth rate of the market declines. A question mark may or may not be worthy of the additional investment that would be required to increase its market share. It needs careful analysis to determine whether or not to invest more money in it. Because a question mark needs to increase its market share quickly in order to avoid turning into a dog, pricing of a question mark should be aggressive.

A **cash cow** is in an industry with a low market growth rate, but the product has a high share of the market. Cash cows are in mature markets in which the growth rate has slowed, but they are market leaders. Cash cows generate more cash than they consume. They are regarded as boring, but any company would be glad to have them. They should be "milked" to extract their profits without investing much cash in them. Investment in a cash cow would be wasted money because of the slow growth of the industry. The characteristics of a cash cow product do not change much, customers know what they are getting, and the price does not change much either.

A **dog** is in a mature industry with a low market growth rate, and it has a low share of the market. A dog does not consume much cash, but it does not generate much cash, either. It is usually barely breaking even. The investment money tied up in it has little potential, and it depresses the company's Return on Assets. Dogs should be sold off, and pricing is not a major concern.

The natural life cycle for a business unit or a product is that it begins as a **question mark**, then turns into a **star**, then when the market stops growing, it turns into a **cash cow**. At the end of its life cycle, the **cash cow** turns into a **dog**.

However, if the **question mark** never achieves **stardom**, it goes straight to **dogdom** when the market's growth rate slows.

A diversified company with a balanced portfolio will have some **stars**, some **question marks**, and some **cash cows**. The **stars'** high market share and high growth rate assure the future. The **question marks** have potential to become stars if they receive the necessary investment. The **cash cows** supply the cash to fund the future growth of the stars and the question marks.



## Budgeting Concepts

We are all familiar with budgets in at least an informal manner. We often see them at work or are impacted by them when something cannot be done because it is “not in the budget.” The budget is developed in advance of the period that it covers, and it is based on forecasts and assumptions. But the budget is not something that is primarily for the purpose of restricting what can be done. It is intended as a planning tool and is a guideline to follow in order to achieve the company’s planned goals and objectives.

The budgeting process is inseparably linked to the planning process in an organization. Major planning decisions by management are required before the budget can be developed for the coming period. Furthermore, the development of the budget may cause previously developed short-term plans by management to require adjustment. As the projected quantitative results of the plans become clear in the developing budget, management may need to revise its plans. After the plans and the budget have been adopted, as the period unfolds the budget provides control and feedback.

In this section, we will look at the different types of planning and budgets and how the planning and budgeting process within a company works. We will also examine the reports that come about as a result of the budget, along with the different types of budgets that may be prepared.

## Budgeting

### The Relationship Among Planning, Budgeting, and Performance Evaluation

Planning, budgeting, and performance evaluation are interrelated and inseparable. Here is an overview of the process:

- 1) Management develops the **plan**, which consists of goals, objectives, and a proposed plan of action for the future. The plan includes the company’s short-term as well as long-term goals and objectives and its business opportunities and risks. For example, a plan may look at the future from the perspective of expanding sales, increasing profit margin, or whatever the company sees as long-term goals. The plan is a guide showing where the company needs to be in the future.
- 2) The plan developed by management leads to the formulation of the **annual profit plan**, also called the **budget**. These two terms will be used interchangeably throughout this section. The profit plan expresses management’s plans for the future in **quantitative terms**. The profit plan also identifies the resources that will be required in order to fulfill management’s goals and objectives and how they will be allocated. The budget should include performance of the company as a whole as well as the performance of its individual departments or divisions. Managers at all levels need to reach an understanding of what is expected.
- 3) Budgets can lead to changes in plans and strategies. Budgets provide **feedback to the planning process** because they quantify the likely effects of plans that are under consideration. This feedback may then be used by managers to **revise their plans** and possibly their strategies as well, which will then cause revisions to the profit plan during the budgeting process. This back and forth exchange may go on for several iterations before the plans and the budget are adopted.
- 4) Once the plans and the budget have been coordinated and the budget adopted for the coming period, as the organization carries out its plans to achieve the goals it has set, the **master budget** is the document the organization relies upon as its operating plan. By budgeting how much money the company expects to make and spend, the company creates a series of ground rules for people within the organization to follow throughout the year.
- 5) Actual results are compared to the profit plan. The profit plan is a **control tool**. Controlling is defined as the process of measuring and evaluating actual performance of each organizational unit of an enterprise and taking corrective action when necessary to ensure accomplishment of the firm’s goals and objectives. The profit plan functions as a control tool because it expresses what measures will be used to evaluate progress. **A regular (monthly or quarterly) comparison of the actual**



**results—both revenues and expenditures—with the profit plan will give the company's management information on whether the company's goals are being met.** This comparison should include narrative explanations for variances and discuss the reasons for the differences so that mid-course corrections can be made if necessary.

- 6) Sometimes, this control will result in the revision of prior plans and goals or the formulation of new plans, changes in operations, and revisions to the budget. For example, if changes in the company's external environment cause variances in revenues and/or costs to become extreme, a new short-term profit plan covering the remainder of the year may be necessary.
- 7) Changed conditions during the year will be used in planning for the next period. For example, if sales decline, the company may plan changes in its product line for the next period in order to reverse the trend.

### Advantages of Budgets

When properly developed and administered, budgets:

- Promote **coordination** and **communication** among organization units and activities.
- Provide a **framework for measuring performance**.
- Provide **motivation** for managers and employees to achieve the company's plans.
- Promote the **efficient allocation of organizational resources**.
- Provide a means for **controlling operations**.
- Provide a means to **check on progress** toward the organization's goals.

#### Coordination and Communication

**Coordination** means balancing the activities of all the individual units of the company in the best way so that the company will meet its goals and the individual units of the company will meet their goals. **Communication** means imparting knowledge of those goals to all employees.

For example, when the sales manager shares sales projections with the production manager, the production manager can plan and budget to produce the inventory that is to be sold. And the sales manager can make better forecasts of future sales by coordinating and communicating with branch managers, who may be closer to the customers and know what they want.

#### Measuring Performance

Budgets make it possible for managers to measure actual performance against planned performance. The current year's budget is a better benchmark than last year's results for measuring current performance. Last year's results may have been negatively impacted by poor performance and the causes may have now been corrected. In this case, using last year's results would set the bar too low. Furthermore, the past is never a good predictor of the future, and the profit plan should reflect the conditions anticipated for the coming period, not the conditions that existed in the past period or periods.

**However, performance should not be compared against the current budget only**, because that can result in lower-level managers setting budgets that are too easy to achieve. It is also important to measure performance relative to the performance of the industry and even relative to performance in prior years.

#### Motivating Managers and Employees

A challenging budget improves employee performance because no one wants to fail, and falling short of achieving the budgeted numbers is perceived as failure. The goals quantified in the budget should be demanding but achievable. If goals are so high that they are impossible to achieve, however, they are demotivating.

### Efficient Allocation of Organizational Resources

The process of developing the operating budgets for the individual units in an organization includes identifying the resources that each unit will need to carry out the planned activities. For example, the process of developing the production budget requires projections for direct materials and direct labor that will be required to produce the planned output. The process of budgeting for administrative salaries requires forecasts of administrative employees that will be needed by each department. If funds will be available for only a certain number of administrative employees in the organization, some units' projections may have to be adjusted. This leads to efficient allocation of organizational resources.

Efficient allocation of organizational resources during the budgeting process may also include making decisions about the most profitable way to utilize the resources available. A decision about what product or products to produce may need to be made under a situation of **constraint**. A constraint exists when one or more of the factors of production are limited in some way. This type of decision would be required if a plant were operating at full capacity and management wanted to maximize net income without being able to increase capacity.

Decisions made under situations of constraint are usually short-run decisions. In the short run, managers must do the best they can with the resources they have. In the long run, however, capacity can be expanded and constraints eliminated, or at least reduced.

When operating at capacity, operating income is maximized by maximizing contribution margin **per unit of the resource that is limiting either the production or the sale of products**.

**Example:** Carl Corporation has only 3,000 machine hours available to produce its products. It is operating at full capacity and can sell all the products it manufactures. Carl Corporation produces two products: racks for electronic equipment and file cabinets. The price and variable costs and the number of machine hours required to produce each product are as follows:

	<u>Per Unit Data</u>	
	<u>Racks</u>	<u>File Cabinets</u>
Selling Price	\$450.00	\$600.00
Variable Costs	<u>200.00</u>	<u>300.00</u>
Contribution margin	\$250.00	\$300.00
Machine hours/unit	2	4

Which product should Carl Corporation budget to produce, using its available 3,000 machine hours, assuming fixed costs are the same under either option?

#### **Solution:**

Since the constraint is the number of available machine hours, Carl should produce the product that provides the highest contribution per machine hour.

The rack's contribution margin per machine hour is  $\$250 \div 2$ , or **\$125**.

The file cabinet's contribution margin per machine hour is  $\$300 \div 4$ , or **\$75**.

Even though the contribution margin for one file cabinet is higher than the contribution margin for one rack, since the racks have the higher contribution **per machine hour** required to produce them, Carl should produce only racks. Racks return a higher contribution per unit of the scarce resource.

#### **Proof:**

Using 3,000 machine hours, Carl Corporation would be able to produce 1,500 racks, since each rack requires 2 machine hours. Thus, the total contribution margin for racks during a month's time would be  $1500 \times \$250$ , or \$375,000.

Using the same 3,000 machine hours, Carl Corporation would be able to produce 750 file cabinets, since each file cabinet requires 4 machine hours. The total contribution margin for file cabinets during a month's time would be  $750 \times \$300$ , or only \$225,000.

Therefore, in the short run, under the existing constraint of 3,000 machine hours available per month, producing only racks will maximize operating income.

### Controlling Operations and Checking on Progress Toward Goals

**Control** refers generally to the set of procedures, tools and systems that a company uses to ensure that progress is being made toward accomplishing its goals and objectives. Financial control is achieved by comparing actual results to budgeted financial amounts. Thus budgets provide the standard against which actual financial results are compared. Differences between the actual and the budget are called **variances**, and **variance analysis** is performed to determine whether the variances are favorable or unfavorable. Variance analysis is covered in this book in Section C, *Performance Measures*.

Question 59: A company is preparing the sales budget for two potential products. Both products require the use of the same manufacturing equipment, which is only available for 60 hours each month. The contribution margin of product A is \$95 per unit and the contribution margin of product B is \$55 per unit. Product A requires 4 hours of machine time per unit and product B requires 2.5 hours per unit. In order to efficiently allocate the equipment resources, the company should manufacture

- a) product A, because the contribution margin is more per unit than product B.
- b) product B, because they can produce more units of that product than product A.
- c) product A, because it will make better use of the equipment than product B.
- d) product B, because it will make better use of the equipment than product A.

(ICMA 2013)

### Time Frames for Budgets

A **profit plan** is generally prepared for a set period of time, commonly for one year, and the annual profit plan is subdivided into months or possibly quarters. Usually the profit plan is developed for the same time period covered by a company's fiscal year. When the budget period is the same as the fiscal year, budget preparation is easier and comparisons between actual results and planned results are facilitated. This comparison is called a **variance report**. Variance reporting will be covered in detail in the next major section, *Performance Management*.

Budgets can also be prepared on a continuous basis. At all times, the budget covers a set number of months, quarters, or years into the future. Each month or quarter, the month or quarter just completed is dropped and a new monthly or quarterly budget is added to the end of the budget.

For example, in September 20X3, the rolling budget will cover the months of October 20X3 through September 20X4. In October 20X3, the rolling budget will cover the months of November 20X3 through October 20X4.

At the same time as a month or quarter is dropped and a new month or quarter is added, the other periods in the budget can be revised to reflect any new information that has become available. Thus, the budget is continuously being updated and always covers the same amount of time in the future. This is called a **rolling budget** or a **continuous budget**.

When continuous budgeting is used, budgeting and planning are always being done. Advantages are:

- Budgets are no longer done just once a year.
- A budget for the next full period (usually 12 months) is always in place.
- The budget is more likely to be up to date, since the addition of a new quarter or month will often lead to revisions in the budget for the repeated periods.
- Managers are more likely to pay attention to budgeted operations for the full budget period.

Firms usually have longer-term budgets, as well. Budgets for the years beyond the coming year usually contain only essential operating data and do not attempt to present a full operating and financial budget.

Having a long-term budget along with the coming year's master budget enables management to quantify the effect of its strategic plans on future short-term operations.

### Methods of Developing the Budget

Budget development can be done using a participative process, an authoritative process, or a consultative process.

A **participative** budget is developed from the bottom up. All the people affected by the budget are involved in the budget development process, even lower-level employees. This type of budget development involves negotiation between lower-level managers and senior managers.

An **authoritative** budget is developed from the top down. Senior management prepares all the budgets for every segment of the organization. The budgets are imposed upon the lower-level managers and employees.

A **consultative** budget is a combination of authoritative and participative budget development methods. Senior management asks for input from lower-level managers but then develops the budget with no joint decision-making or negotiation involved.

These methods all have their advantages and disadvantages.

### Advantages and Disadvantages of Participative Budget Development

**Advantages** include the following:

- A participative budget is a good communication device. The process of preparing the budget participatively gives senior managers a better grasp of the problems their employees face. The employees' knowledge is more specialized and they have the hands-on experience of running the business on a day-to-day basis. At the same time, employees gain a better understanding of the problems experienced by top management.
- A participative budget is more likely to gain employee commitment to fulfill budgetary goals. People are more willing to devote extra effort to attain goals they perceive as their own.
- A participative budget is more likely to be achievable because it was developed with input from the people responsible for achieving it.

**Disadvantages** include the following:

- Unless senior management controls the budget process properly, a participative budget can lead to budget targets that are too easy to achieve, or **budgetary slack**. Budgetary slack, which will be discussed later in more depth, is the practice of underestimating planned revenues and overestimating planned costs to make the overall budgeted profit more achievable. It is the difference between the amount budgeted and the amount the manager actually expects.
- Integrating corporate strategic plans into the budget can be more difficult when it has a bottom-up process.
- Participative budgeting is more time-consuming than authoritative budgeting because lower-level managers and employees need to meet and negotiate their budgets.

### Advantages and Disadvantages of Authoritative Budget Development

**Advantages** include the following:

- An authoritative budget process gives senior management better control over the decision-making process than participative budgeting.
- Authoritative budgeting places more emphasis on the achievement of the strategic plans developed by top management.

- Authoritative budget development can be done more rapidly and with greater flexibility than participative budgeting because it eliminates the need to meet with lower-level managers to negotiate their budgets.
- Budgetary slack is not a problem.

**Disadvantages** include the following:

- Because lower-level managers and employees (that is, those responsible for implementing the budget) have no input into the budget development process, they will usually have less commitment to the budget and be less accepting of it.
- An authoritative budget issues, or dictates, orders. People are likely to resent being given orders and a morale problem may result.
- Because an authoritative budget lacks input from lower-level managers, its objectives may not be practical or possible to achieve because it does not take into account existing limitations that senior management might not be aware of.
- Communication between senior management and lower-level management and employees is reduced with an authoritative budgeting process.

### **Advantages and Disadvantages of Consultative Budget Development**

Since consultative budget development is a compromise between participative and authoritative budgeting, it has many of the advantages and disadvantages of both.

- Since senior management makes the final decisions without any negotiation, management maintains control over the process. As a result, senior management's strategic plans are integrated into the budget and budgetary slack is not a problem.
- The amount of time required to develop a consultative budget is greater than the time required for an authoritative budget but less than the time required for a participative budget.
- If lower-level managers see the input they provided incorporated into the final budget, they may be nearly as accepting and committed to the budget as they would have been had it been developed participatively. However, if they feel their input has been disregarded, they may be even more resentful than if they had never been asked to provide input in the first place. To ask for input and then not use it is dismissive. The lower-level managers whose input has been ignored could probably not be expected to provide much input into future budget development processes.

### **Who Should Participate in the Budgeting Process?**

An effective budgeting process usually combines various approaches: bottom-up, top-down, and negotiation. Either senior management or a budget committee made up of senior managers provides budget guidelines based on their strategic plans, assumptions about the economy, and other relevant factors. Department and division heads prepare initial budgets based on those guidelines and send them to senior management for compilation into a consolidated budget and for review. Senior managers review the initial budgets and send them back to the department heads for revision. After several rounds of negotiations, the budget is finalized.

The importance of senior management's involvement cannot be over-emphasized. The support of top management is crucial in order to obtain successful development and administration of the budget. Furthermore, top management support is necessary in order to gain lower-level management participation. If lower-level managers feel that top management does not support the effort, they are not likely to support it either.

Different organizations will structure their budget development processes differently, depending upon each organization's needs and culture. The budget development process that follows is a general one and is not prescriptive.

## The Budget Development Process

We will discuss specific budgets and their development later. However, the process for developing each budget is similar. The main steps in this process are:

- 1) **Budget guidelines are set and communicated.** This may be done by a budget committee or by senior management. The initial budget guidelines govern the preparation of the profit plan. Information considered in the development of the budget guidelines includes the general outlook for the economy and the markets the company serves, strategic objectives and long-term plans, expected operating results for the current period (since a budget for the coming period is developed toward the end of the current period before the current period has been completed), specific corporate decisions for the coming period (such as corporate downsizing), response to environmental requirements, and short-term objectives.
- 2) **Initial budget proposals are prepared by responsibility centers.** Each responsibility center manager prepares an initial budget proposal using the budget guidelines as well as their own knowledge about their own area (such as introduction of new products or changes to be made in product design or manufacturing processes).
- 3) **Negotiation, review, and approval.** The responsibility center managers submit their initial budget proposals to the next level up for review. The initial proposals are reviewed for their adherence to the budget guidelines and to determine whether the budget goals are reasonable and in line with the goals of the next higher unit and with those of other units. Any changes that are needed are negotiated between the responsibility center managers and their superiors. Budgets go through successive levels of management, and at each point they may be renegotiated. These negotiations are the most important part of the budget preparation process and also the most time-consuming part. Eventually, all of the individual unit budgets are combined into the consolidated master budget (first draft). The consolidated master budget will consist of a set of budgeted financial statements: balance sheet, income statement, and statement of cash flows. The consolidated master budget is reviewed at the topmost level to determine whether it meets the requirements without being unachievable, and negotiations begin again for revisions. Finally, when the consolidated master budget meets the approval of the budget committee or senior management, the CEO approves the entire profit plan and submits it to the board of directors for final approval.
- 4) **Revisions.** Even after the profit plan has finally been adopted, it should be able to be changed if the assumptions upon which it was built change significantly. New information about internal or external factors may make revision of the profit plan necessary. In addition, periodic review of the approved budget for possible changes or use of a continuous budget that is continually being updated might be advisable. Although updating the budget provides better operating guidelines, budget revisions that are too easy or too frequent might encourage responsibility centers to not take the budgeting process seriously. The budget should be revised only when circumstances have changed significantly and the changes are beyond the control of the responsibility center manager or the organization.
- 5) **Reporting on variances.** A budget is meaningless unless actual results are compared to the planned results for the same period. The budget needs to be used to monitor and control operations to meet the company's strategic objectives. The comparison between actual results and planned results is called **variance reporting**, and it should take place at every budget unit level. Responsibility center managers should report on variances within their responsibility centers at the end of each reporting period (monthly or quarterly) to their superiors, who then compile the reports they receive into a variance report that is sent to the next level up, and so on. Variance reporting should include not only the amounts of the variances but also the causes of the variances that can be identified.
- 6) **Use of the variance reports.** Variance reports should be used at every level to identify problem areas and to make adjustments to operations, if necessary. For example, a production variance report might reveal that direct materials usage during the past month was greater than planned for the actual output that was produced. The production manager should investigate and determine the cause. Inferior materials may have caused the variance and if so, the purchasing manager may need to get involved in the variance reporting. If a change in supplier is needed to correct the situation, that change should be made immediately.



### Best Practice Guidelines for the Budget Process

Best practices in budgeting include the following, some of which have already been discussed:

- **The development of the profit plan should be linked to corporate strategy.** The development of the profit plan should begin with the company's short- and long-term plans. Linking them gives the managers and employees a clearer understanding of strategic goals, which leads to greater support for goals, better coordination of tactics, and ultimately stronger company performance. Furthermore, without input from planning, the budget will usually just recreate the previous year's results with some minor changes, making it useless as a planning tool.
- The firm's management should assess the future as it pertains to the firm's strategic goals and **use the budgeting process to minimize the adverse effects** that anticipated problems might have on operations.
- The profit plan **must have the support of management** at all levels. The support of top management is critical to gain the support of lower-level managers, and the support of lower-level managers is critical in order to gain the support of the affected employees.
- **Communication is vital.** Management must communicate strategic objectives. But in order to develop those objectives, management needs information from all areas of the organization about customers, competitors, the economy, new technology, and so forth. Much of this information comes from customer contact and support units. When the people who are charged with carrying out the profit plan are able to have input into the plan's development rather than having it imposed upon them, they will feel ownership of the profit plan. Effective communication among all levels of the organization leads to challenging but achievable budgets.
- **The profit plan should be coordinated,** and operating activities of diverse business units should be synchronized. For example, the sales manager will want to make as many sales as possible, whereas the credit manager will want to limit bad debt write-offs. A coordinated effort to establish credit standards that both managers can support should be incorporated into the budgeting process.
- **Budgeting should not be rigid.** If revenue decreases are anticipated for the coming year, an "across the board" cost reduction applied to all areas can create additional problems. A coordinated effort should be made to find where making cuts would do the least damage to company operations.
- The profit plan should be a **motivating device.** It should help the people in the organization to work toward the organization's goals for the improvement of the company. The profit plan is more likely to be successful if everyone concerned, from managers to their employees, **sees the profit plan as a tool to help them do a better job** and not as a rigid taskmaster or a tool for top management to assess blame.
- **Design procedures to allocate funding resources strategically.** This can be done during the review process for the individual responsibility center budgets. Managers reviewing several responsibility center budgets can see how changes in one budget will affect other budgets. The company's weighted average cost of capital should be a consideration in the allocation process as well. The degree of risk involved in competing plans, the costs or advantages associated with deferring action, and factors such as expected developments in interest rates might also be used to allocate resources. By using these types of measures to allocate funding, companies can better select plans whose benefits will produce the desired results. By monitoring the results of their allocations, companies can refine and improve their allocation procedures.
- **Managers should be evaluated on performance measures other than simply meeting budget targets.** Meeting budget targets should be secondary to other performance measurements. (See *Budgetary Slack and Its Impact on Goal Congruence and Performance Management* for further discussions.)
- **Link cost management efforts to budgeting.** Accurate cost information during the budgeting process is basic to budgeting. Companies that use accurate cost management techniques and provide managers developing their budgets with access to cost information improve both the accuracy and the speed of their budget process.

- **The strategic use of variance analysis.** Use of variance analysis to identify weaknesses enables managers to identify areas where their organization needs to improve its performance. However, this attention should be focused on those variances that have a significant impact on profitability so that decision making and budgeting do not get bogged down in insignificant details.
- **Reduce budget complexity and budget cycle time.** The budget process should be streamlined as much as possible through controlling the number of budgets that are needed and by standardizing budgeting methods. Automate budgeting as much as possible through the use of information technology and make sure that the budget developers know how to use new technologies.
- **The time period for a budget should reflect the purpose of the budget.** If a new product is under consideration and the purpose is to budget for the total profitability of the product, the capital budgeting period should include the design, manufacturing, sales, and after-sales support for the expected life of the product.
- **Develop budgets that can be revised if necessary.** A budget should be flexible. If conditions change during the budget period, the budget should not be used as an excuse for not doing something that is strategically important to the company, such as acting on an unforeseen business opportunity that arises. If an unplanned large maintenance expense is needed, the budget should not require a manager to postpone repairs if doing so will hurt the company in the long run. By having a process in place to revise the budget when change is warranted, a company can respond to competitive threats or opportunities more quickly. Furthermore, when budget developers know that the budget will have some flexibility, they will feel less need to pad their budgets with budgetary slack (see *Budgetary Slack and Its Impact on Goal Congruence*, below), which they otherwise might do in order to cover any possible development. This leads to more realistic profit plans.
- **Review the profit plan on a regular basis throughout the year.** These reviews should report on changes in business conditions and alert managers that new tactics may be called for if they are to meet their targets for the year. This goes along with revising the budget when necessary. The budget should not be revised to cover up for poor performance or poor planning, but best-practice companies choose to revise the profit plan rather than stick with a plan that no longer reflects current conditions.

### Budgetary Slack and Its Impact on Goal Congruence

**Goal congruence** is defined as “aligning the goals of two or more groups.” As used in planning and budgeting, it refers to the aligning of goals of the individual managers with the goals of the organization as a whole. Sometimes the performance of an individual manager’s unit will benefit from an action the manager takes, but the overall performance of the company is either not impacted at all or it may actually be negatively impacted. An individual division manager may reject a capital investment that would improve the company’s total profits because the proposed project’s return on investment would cause his own division’s return on investment to decrease. Situations like these occur because the goals of the individual managers are not aligned with the goals of the company.

The company’s strategic objectives are communicated to individual managers as part of the planning and budgeting process. However, there is a hazard in budgeting because it may lead to behaviors on the part of managers that benefit them or their department but are not congruent with the goals of the company. This is more likely to occur if managers’ performance will be evaluated according to whether they meet their budget targets. Managers who develop the budgets they are going to be accountable to meet may build in **budgetary slack** in order to make sure their budgets are achievable without any risk of failure. Budgetary slack is the difference between the amount budgeted and the amount the manager actually expects. It is the practice of **underestimating planned revenues** and **overestimating planned costs** to make the overall budgeted profit more achievable.

On the positive side, budgetary slack can provide managers with a cushion against unforeseen circumstances. This can limit managers’ exposure to uncertainty and thereby reduce their risk aversion. The reduced anxiety about risk may help the managers make decisions that are more closely congruent with the goals of senior management.



However, budgetary slack often creates more problems than it solves.

For example, budgetary slack can misrepresent the true profit potential of the company and can lead to inefficient resource allocation and poor coordination of activities within the company. As a result, planning inaccuracy spreads throughout the company. If sales are planned too low, production will also be planned too low, possibly leading to product shortages because budgeted demand has been understated. The advertising program and distribution expense budgets may be planned incorrectly, and the cash budget might be inaccurate.

The best way to avoid the problems caused by budgetary slack is to use the profit plan as a planning and control tool but not for managerial performance evaluation. If the company does use the budget to evaluate managers, it could reward them based on the accuracy of the forecasts they used in developing their budgets. For example, the company's senior management could say that the more accurate a division manager's budgeted profit forecast is and the greater the amount by which it is exceeded, the higher the manager's bonus will be.

### Responsibility Centers and Controllable Costs

Control in an organization is exercised through responsibility centers. Therefore, as we have maintained throughout this discussion, budgeting must also be done at the responsibility center level. However, responsibility center managers should be responsible for budgeting only the costs that they can control.

**Note:** When we look at performance measurement in Section C, we will see this idea again. In Section C we discuss that managers should only be evaluated on things that they are able to control or influence.

Some costs are controllable by a given manager and some costs are not. "**Controllable costs**" refers to costs for which the manager has the authority to make the decisions about how money will be spent. "**Non-controllable costs**" refers to costs that are ordinarily controlled at a higher level in the organization, such as the manager's salary or bonus. The manager's salary or bonus **is** controllable, but not by the manager. The manager's salary will usually be assigned to his or her responsibility center's budget and will appear on reports comparing actual results to the budgeted amount, but the manager should not be held responsible for it.

The allocation of the indirect costs of the organization as a whole may be another non-controllable cost, since indirect costs may be allocated on any of a number of bases, some of which may be controllable by the manager of the responsibility center and some of which may not.

Each budgeted cost assigned to a responsibility center should be identified as either controllable or non-controllable by that responsibility center's management. For example, salaries in the accounting system may be segregated in two accounts: controllable salaries and non-controllable salaries. Each would then be budgeted by the person who has control over it, and that person would be responsible for explaining the variances.

All costs should be included on **some** manager's variance report and identified as the responsibility of that manager on whose report they appear. If an expense is classified as non-controllable on a given manager's budget reports, then that expense should be included as a controllable expense on the report of the higher-level manager who makes the decisions that affect that expense.

**Note:** All costs should be controlled by someone. Whenever no one is responsible for a cost, the uncontrolled cost creates great risk for the company.

It is also important to recognize that fixed costs and indirect costs are not always uncontrollable, and variable costs and direct costs are not always controllable. The nature of each cost will vary according to its characteristics and each cost should be analyzed to determine who controls it.

This distinction between controllable and non-controllable costs is especially important if managers' performance evaluations will be dependent upon meeting budgetary targets. (Although we have said this is

not a good idea, it may be done in some organizations.) If other performance measures are used to evaluate managers, this distinction may be less important.

Regardless of whether or not managers' evaluations are affected by their meeting budgetary targets, the person who is responsible for making the decisions that affect a cost should still be the person who reports on variances between the actual and planned costs, because that person is responsible for budgeting for the cost and for making spending decisions. That person should also make any operational adjustments that those variances may identify as needed.

### Standard Costs Used in Budgeting

When standard costing is used in manufacturing, the terms **standard cost**, **budgeted cost**, and **planned cost** are used interchangeably. We will discuss standard costing in more detail later, because a standard cost system is a common method of cost measurement for manufacturing costs. For now, a few basic concepts are important because when standard costs are used, standard costs are also budgeted costs.

Standard costs are the estimated manufacturing costs for direct materials, direct labor, and manufacturing overhead that are **predetermined** or **estimated** as they would occur under the conditions in the budget. Standards are usually based on interviews, analyses and engineering studies that identify the time needed for the various activities required to manufacture a product, the amount of direct materials needed for each product, and the cost for each unit of time or unit of direct materials.

A standard cost specification is developed for each product (in process manufacturing) or for each job (in job-order manufacturing). It consists of the standard costs for material, labor, and overhead for the product or job. The standard cost analysis includes the costs for materials, labor, and overhead in each of the various responsibility centers through which the work flows. Standard cost specifications are designed in accordance with each individual situation.

- A **standard input** is the quantity of the input (such as kilograms or the number of units of direct material or hours of direct labor) required to produce one unit of output.
- A **standard price** is the price the company expects to pay for one unit of an input.
- A **standard cost** is the cost of producing one unit of output. It is the sum of the products of each standard input multiplied by its standard price.
  - The **standard direct material cost per unit of output** is the standard material input **allowed** for one unit of output multiplied by the standard price per unit of that direct material input.
  - The **standard direct labor cost per unit of output** is the standard direct labor hours **allowed** for one unit of output multiplied by the standard price per direct labor hour.

Standard costing is used to apply costs to production. Although there are other methods of applying costs to production, most manufacturers use standard costing. For a manufacturer using standard costing, standard costs are a fundamental element of the budgeting process. They are used to develop the budgeted costs per unit for manufactured goods.

**Note:** Without standard costs it would be very difficult to budget, since we would not know how much it will cost to produce our products. Also, without standard costs it would be very difficult to evaluate our performance because at the end of the year we would not know how much it should have cost to produce what was produced.

Standard costs are based on assumptions about the quantity of direct inputs needed to produce one unit of product and the cost per unit of those direct inputs. Standard costs also include assumptions about the cost for manufacturing overheads that should be allocated to each unit produced. The assumptions used, such as the number of direct labor hours allowed for each unit produced, should be challenging but attainable under normal conditions. If the standards are too rigorous, they will not be attained and the company will have large variances in its reporting that may cause inventory and cost of goods sold to be reported improperly.

**Note:** A **flexible budget** is a budget that is prepared using the standard costs and the **actual** level of activity (sales or production, as appropriate); it is essentially what the budget would have been if the company had known what the actual level of sales or production would be in advance and had used that information when it developed the budget. (Flexible budgeting is covered in much more detail in the section on Budget Methodologies.)

Flexible budgets work with standard cost systems. The standard cost system provides data for the computation of the predetermined overhead rates to use in the flexible budget, for variance analysis of overhead expense, and for variance analysis of the direct inputs, which are direct materials and direct labor. (Variance analysis is covered in Section C.)

## Setting Standard Costs

Because so much of a company's budget is based on the standards that have been set (both usage standards and cost standards), it is critical that these standards be as accurate and as realistic as possible. A number of different methods can be used to establish the standards. In most cases, a company will use a combination of methods such as:

- Activity analysis.
- Historical data.
- Target costing.
- Strategic decisions.
- Benchmarking.

### 1) Activity Analysis

**Activity analysis** involves identifying and evaluating all the input factors and activities that are required to complete a job, a project, or an operation efficiently. Activity analysis is the **most accurate way of determining standard costs** if it is properly executed. This analysis should be performed by people from several different areas, including product engineers, industrial engineers, management accountants, and the production workers.

Product engineers specify the components to be used in the manufacturing of a product. Industrial engineers analyze the procedures required to complete the manufacturing process. Production workers are interviewed to gain their input. Management accountants work with the engineers to complete the analysis.

The activity analysis specifies the quantity and the quality of the direct materials, the required skills and experience of the employees who will produce the product, and the equipment to be used in producing the product. Management accountants calculate the costs of the direct materials, the labor, the overhead, and other items to determine the total standard cost.

**Note:** The standard costs as developed should include not only the quantity of each direct material or direct labor that should be used but also its quality (in the case of materials) or its skill level (in the case of labor). The quality of the materials and the skill of the labor required are directly connected to the cost, so a minimum level of quality for materials and a minimum skill level for labor must be established as part of each standard cost.

## 2) Historical Data

While activity analysis is the most accurate means to determine standard costs, the cost of the activity analysis itself can be prohibitively high. If a firm cannot justify the high cost of activity analysis, it can use historical data instead. Data on **costs involved in the manufacture of a similar product in prior periods** can be used to determine the standard cost of an operation, if accurate data is available.

Analysis of historical data is much less expensive than an activity analysis for determining standard costs. However, a standard cost based on the past may perpetuate past inefficiencies. Furthermore, a standard based on the past does not incorporate continuous improvements, which are an important consideration in the competitive environment in which businesses operate today.

## 3) Target Costing

Target costing is used when a firm has a specific selling price at which it desires to sell its product in order to be competitive. The target cost is **the cost that yields the required profit margin for the product**, given a set selling price. Standards are then determined so that the product can be manufactured at the target cost.

## 4) Strategic Decisions

Strategic decisions can also affect a product's standard cost. If management has made a strategic decision to pursue **kaizen**, the Japanese term for **continuous improvement**, this will impact the standard because the standard will be set at the most challenging level at all times in order to effect continuous improvement.

Other strategic decisions can affect a product's standard cost. For example, a management decision to replace an obsolete piece of equipment with a new machine would require that standards and standard costs be updated.

## 5) Benchmarking

Input into the standard-setting process may come from **benchmarks**, or industry information about current practices of other firms or current practices of the best-performing divisions within the same company.

If data from other firms is used to set standards, the other firms do not always need to be in the same industry or country. If they have similar operations, they can offer good guidelines even if they are from a different industry or country.

Benchmarking data can also come from associations of manufacturers that collect information from their members.

In benchmarking, the best performance anywhere can be chosen as the attainable standard. Using the best-performing company as a standard can help a firm maintain its competitive edge. However, the benchmark must be evaluated in light of the company's own unique situation.

## Who Should Set the Standards?

This question is similar to the question about who should prepare a budget. The answer is also very similar to that for budgeting. Standards can be established by top management, by the workers on the assembly line, by some level of management between the two, or by any combination of levels in the organization. A company can use either an **authoritative** or a **participative** procedure in setting the standard costs that will be used in the standard cost system and in the flexible budget.

- When following an **authoritative** standard-setting process, management sets the standards and they are handed down to those charged with their execution.

The **advantages** of an authoritative standard-setting process include:

- All the factors that affect the costs will receive proper consideration,
- Management's expectations will be reflected in the resulting standard costs, and

- The standard-setting process can be handled more expeditiously than is possible when more individuals are involved.

The **disadvantage** of authoritative standard-setting is that the affected employees will not see the standards as their own and will be less likely to accept them, which in turn reduces their motivation to achieve the standards.

- A **participative** standard-setting process involves all the employees who will be affected by the standard. When employees participate in setting the standards, they are more likely to accept them and not see them as unreasonable. The disadvantage of setting standards in a participative manner is that the resulting standards may not support achievement of the firm's strategic goals or operating objectives.

Even when an authoritative standard-setting process is followed, production employees and supervisors must be involved in some aspects of the process. These people are close to the production process and their input is important if management expects to do a good job of setting the standards. The actual standard setting is accomplished through the efforts of management, product design engineers, industrial engineers, management accountants, production supervisors, purchasing, personnel, and employees affected by the standards.

### Establishing Direct Materials Standards

Three considerations go into establishing a standard cost for direct materials:

- 1) Required **quality** of materials.
- 2) The **quantity** needed.
- 3) The **price** per unit of materials.

Specifying the **quality** is the first step, because the quality of the direct materials will affect all phases of production, such as the quantity of the materials that will be required, the time required for processing, and the amount of supervision that will be needed during the production process. The marketing department, engineering department, production department, and management accountants all need to be involved in making the determination of the quality in order to assess the trade-offs that will be involved as well as determine the **optimum quality that will produce the lowest overall cost and still meet the demands of the market**.

After the quality has been specified, the standard for the **quantity** of direct materials needed to manufacture the product is set. The quantity standard is based on the product design, the cost drivers<sup>28</sup> of the manufacturing activities, the quality of the direct materials, and the condition of the plant and equipment that will be used to manufacture the product. The industrial engineering department, the production department, and the management accountants work together to develop the quantity standard.

The **price** standard is developed after the quality and quantity standards, because the quality and quantity standards are considerations in setting the price standard. Timing of the purchases and quantity purchased at one time are considerations, as well. A vendor's record of reliability for delivering the product on time is often more important than finding the lowest price, because missed deliveries may cost more than the savings.

### Establishing Direct Labor Standards

The standard for direct labor depends on the type of work, the nature of the manufacturing process, the type of equipment that will be used, and the required skill level of the employee.

The **quantity** standard for direct labor is determined by the industrial engineers, the production department, the labor union, the personnel department, and the management accountants, each group using some or all of the factors listed above.

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<sup>28</sup> A cost driver is anything (such as an activity, an event, or a volume of something) that causes costs to be incurred each time it occurs.

The **price** standard for direct labor, or the standard **wage rate**, is provided by the personnel department and is a function of the competitive labor market and any labor contracts that may exist. The standard wage rate varies according to the type of employees needed and the skill level required.

The cost standard for labor, whether direct or indirect, includes not only the hourly wage or salary paid but also the employee benefits provided and the payroll taxes that must be paid. Employee benefits may include medical insurance, life insurance, pension plan contributions, and paid vacation. Payroll taxes include unemployment taxes and the employer portion of Social Security and Medicare taxes. Workers' compensation insurance is a requirement, as well. Estimates of these other costs should be made and included in the direct labor standard cost.

### Establishing Manufacturing Overhead Standards

**Overheads** are indirect costs that cannot be traced to any particular unit produced. They include:

- Indirect materials, such as cleaning chemicals, disposable tools, or protective devices.
- Indirect labor, such as plant superintendents, plant janitors, and so forth.
- Other indirect costs, such as depreciation on manufacturing equipment, utilities, and other non-traceable costs.

Overhead can be either variable overhead for which costs fluctuate with changes in production volume (for example, disposable tools), or it can be fixed overhead that does not fluctuate with changes in production volume (for example, depreciation or the plant superintendent's salary). Because fixed costs do not vary with changes in activity whereas variable costs do, fixed and variable overheads are planned separately.

Overhead standards are generally based on costs under normal operating conditions, anticipated volume, and desired efficiency. The total overhead costs used come from the budgeted factory overhead costs. The budgeted factory overhead costs are divided by a **predetermined level of activity** to calculate a standard overhead rate.

### Determining the Level of Activity to Use

In relation to the fixed and variable overhead allocation rates, the company must decide what anticipated activity level to use for its budgeted amounts to calculate the overhead allocation rates that will be used.

The traditional method uses either machine hours or direct labor hours to allocate overhead. As will be discussed later in greater detail, variable and fixed overheads may be allocated using different bases of allocation. For example, variable overhead may be allocated based on labor hours and fixed overhead may be allocated based on the number of units produced.

The steps in calculating the predetermined overhead allocation rate are:

- 1) The company budgets its costs for fixed or variable overhead for the coming year.
- 2) The company decides how much output it will produce during the coming year and, as a function of that output, how many machine hours or how many direct labor hours it plans to use during the year.
- 3) The budgeted dollar amount of fixed or variable overhead is divided by the planned activity level (number of hours) to determine the amount of overhead to allocate to each hour allowed for production of each unit.
- 4) Alternatively, the budgeted dollar amount of fixed or variable overhead can be divided by the number of **units** budgeted to determine the amount of overhead to allocate to each **unit** produced.

**Note: Absorption costing** is used for external financial reporting by manufacturers. Under absorption costing, all manufacturing overhead costs are applied to the units produced and are inventoried after production is completed. The costs of production that have been assigned to each unit flow to the income statement as a part of cost of goods sold only when the units they are attached to are sold. This is the reason that overhead costs need to be applied to units produced instead of being expensed as incurred.

As the activity level is one of the two figures used in the determination of the predetermined manufacturing overhead rates, it will greatly impact the allocation rate.

The allocation rate is established for the full year. Predetermined (standard) allocation rates for fixed manufacturing overhead and variable manufacturing overhead are established separately.

- **Variable manufacturing overhead** is overhead that varies in total with the number of units produced, but its cost per unit remains constant. It includes costs such as supplies used in manufacturing (the more units are manufactured, the more supplies are required) or the electricity required to operate the equipment. Variable manufacturing overhead may be initially budgeted in total and a per-unit cost developed by dividing that total by the number of units initially expected to be produced. However, if the number of expected units is changed during the budgeting process, the budgeted variable manufacturing overhead will be changed in total. Thus, variable manufacturing overhead is usually **budgeted on a per-unit basis**. That is, a budgeted amount is developed per unit produced, and the total budgeted amount is the amount per unit multiplied by the number of units that management expects will be produced during the period.
- **Fixed manufacturing overhead** is indirect manufacturing costs that do not vary in response to changes in activity as long as the activity remains within the relevant range.<sup>29</sup> The types of overhead that go into the calculation of budgeted total fixed overhead are salaries for plant supervisors and depreciation on equipment, to mention just two examples.

Fixed manufacturing overhead costs are **budgeted in total** for the year, not on a per-unit basis. The fixed overhead predetermined cost per unit is the total overhead budgeted amount divided by the number of units management expects to produce. Thus, the budgeted cost per unit depends on the number of units management expects to produce during the period. For example, if total budgeted fixed manufacturing overhead is \$100,000 and management expects to produce 10,000 units, the budgeted fixed manufacturing overhead per unit is \$10. But if management expects to produce only 8,000, the budgeted fixed manufacturing overhead per unit is \$12.50.

This anticipated activity level used in the denominator of the predetermined cost per unit calculation is a very important decision to be made in accounting for fixed manufacturing overhead.

Thus, an expected activity level is used for both variable manufacturing overhead and fixed manufacturing overhead, but it is used in different ways. For variable manufacturing overhead, the budgeted overhead rate per unit or per input is multiplied by each month's budgeted activity level to calculate the total monthly budgeted overhead (see the example following this explanation).

For fixed manufacturing overhead, the total budgeted overhead is divided by the budgeted activity level in either output units or input units to determine the fixed overhead cost per unit produced or the fixed overhead cost per input unit.

### Determining The Budgeted Output or Activity Level

In general, a company has four choices to determine the budgeted output or activity level. Two choices relate to what the plant can **supply** and two choices relate to the **demand** for the plant's output. These are called **denominator-level capacity concepts** because they describe the denominators (divisors) that can be used in the calculation of budgeted per-unit fixed overhead costs.

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<sup>29</sup> The **relevant range** is the range of activity over which a certain cost behavior holds true. The term is used most often to refer to fixed costs. Fixed costs do not vary in response to changes in activity as long as the activity level remains within a certain range. If the activity level drops below or rises above that range of activity, the fixed cost can change in total. An example of this effect is depreciation on factory equipment. As long as production does not rise beyond a certain level, the company will be able to continue production with its existing equipment. But if production requirements rise beyond the level that current equipment can meet, additional equipment will be required and depreciation will increase.



**Supply Denominator-Level Concepts**

- **Theoretical or ideal capacity** – This is the level of activity that will occur if the company produces at its absolute most efficient level at all times. No allowances are made for idle time and downtime, and no adjustments are made for any expected decrease in sales demand. A company will not be able to achieve this level in the long run.
- **Practical (or currently attainable) capacity** – This is the theoretical level reduced by allowances for idle time and downtime but not reduced for any expected decrease in sales demand.

**Demand Denominator-Level Concepts**

- **Master budget capacity utilization (or expected capacity utilization)** – Master budget capacity, also called **expected actual capacity**, is the amount of output actually expected during the next budget period based on expected demand. This level will result in a different overhead rate for each budget period because of increases or decreases in planned production due to expected increases or decreases in demand.
- **Normal capacity utilization** – This is the level of activity that will be achieved in the long run, taking into account seasonal changes in the business and cyclical changes. Seasonal changes in business result from changes in demand during the seasons of the year, and cyclical changes are connected to the larger business cycle. Normal capacity utilization is the level of activity that will satisfy **average** customer demand over a long-term period (such as 2-3 years).

The **master budget capacity** is the best activity level to use for the denominator in calculating budgeted fixed cost per unit for developing standards. That is because the master budget capacity is the activity level that is considered applicable to the period for which the standards are being developed. Variance reporting is much simpler if the activity level used in developing the overhead standard is the same activity level as is used in developing the budgeted overhead costs for the master budget. If different activity levels are used, differences between budgeted costs and standard costs due to the different planned activity levels used will appear in variance reports as additional variances.

U.S. GAAP, in ASC 330, specifically prescribes that **normal capacity** should be used for external financial reporting. The others can be used for internal reporting and decision-making. However, according to ASC 330-10-30-6, in periods of abnormally high production the application rate for fixed overhead should be **decreased** so that fixed overhead is not over-applied. Failure to decrease the application rate would lead to inventories being stated at a cost above their actual cost in external financial statements. Thus, if production in a given year exceeds the level of production used in developing the predetermined fixed overhead application rate, the fixed overhead application rate should be decreased.

Other denominator-level concepts are better choices for other purposes, and those will be discussed later in this text.



**Example:** Total manufacturing overhead is budgeted to be \$900,000 for the budget year: \$600,000 for fixed manufacturing overhead and \$300,000 for variable manufacturing overhead. Output, based on master budget capacity utilization, is budgeted at 500,000 units for the year. The fixed overhead allocation rate, based on budgeted units of production, is \$1.20 per unit ( $\$600,000 \div 500,000$ ), and the variable overhead allocation rate is \$0.60 per unit ( $\$300,000 \div 500,000$ ).

Overhead is allocated based on machine hours, so we need to convert these per-unit rates to rates per machine hour. The standard number of machine hours for each unit produced is 2.0 machine hours, thus total machine hours budgeted for the year are  $500,000 \times 2.0$ , or 1,000,000 hours. Therefore, the amount of overhead to be budgeted for each machine hour allowed for the budgeted output is \$0.60 for fixed overhead ( $\$1.20 \text{ fixed overhead per unit} \div 2.0 \text{ machine hours per unit}$  OR  $\$600,000 \div 1,000,000 \text{ machine hours}$ ) and \$0.30 per hour for variable overhead ( $\$0.60 \text{ variable overhead per unit} \div 2.0 \text{ machine hours per unit}$  OR  $\$300,000 \div 1,000,000 \text{ machine hours}$ ).

Remember that all of the calculations we have made so far are based on budgeted amounts. This means that they can be done before the budget year even begins.

Production is not planned to take place evenly throughout the year. The initial production budget for the first quarter calls for 40,000 units to be produced in January, 50,000 in February, and 45,000 in March. Therefore, the total budgeted variable overhead and budgeted fixed overhead for each month of the first quarter will be:

	<u>Variable Overhead</u>	<u>Fixed Overhead</u>
January	\$24,000	\$48,000
February	\$30,000	\$60,000
March	\$27,000	\$54,000

We can calculate these amounts either by multiplying budgeted number of units by the budgeted costs per unit or by multiplying the budgeted number of machine hours by the budgeted costs per machine hour. We have calculated variable overhead for January using both methods to show that the result is the same:  $40,000 \text{ units} \times \$0.60 \text{ per unit} = \$24,000$ .

$40,000 \text{ units} \times 2 \text{ machine hours per unit} \times \$0.30 \text{ per machine hour} = \$24,000$ .

For the whole year, the total budgeted overhead should equal \$900,000. We will have allocated the budgeted amount unequally to each month in the year, based upon each month's budgeted output.

Now, suppose that was just the first draft of the budget. Following meetings between senior management and the plant manager, it has been agreed that the planned activity (production) level for the year needs to be increased from 500,000 units to 600,000 units.

The amount budgeted per unit for variable manufacturing overhead will not change, but the **total variable manufacturing overhead budgeted for the year will change**. The total variable manufacturing overhead for the year will become  $600,000 \text{ units} \times \$0.60 \text{ per unit}$  (no change in the per-unit cost), or \$360,000, an increase of \$60,000 from the former total of \$300,000.

However, **the total fixed manufacturing overhead will not change** because this production increase is within the relevant range. So the budgeted fixed manufacturing overhead cost **per unit must change**. Because the planned activity level has increased, the budgeted fixed overhead cost per unit must decrease. The total budgeted fixed overhead of \$600,000 will be divided by 600,000 units instead of by 500,000 units, and the budgeted **fixed overhead cost per unit will decrease** from \$1.20 to \$1.00.

In total, the total budgeted overhead cost per unit has now decreased from \$1.80 to \$1.60. This is because the fixed portion of it is now spread out over more units, reducing the fixed overhead per unit. If production had decreased (instead of increasing) in the revised budget, the budgeted fixed and total overhead cost per unit would have increased instead.

Because of the increase in budgeted production, total budgeted overhead cost (fixed and variable) has increased from \$900,000 to \$960,000 (\$600,000 fixed and \$360,000 variable). Note that the total budgeted fixed manufacturing overhead stayed the same and only the budgeted total variable manufacturing overhead increased.

The difference in cost behavior between fixed and variable manufacturing overhead costs is very important to understand.

Question 60: Which one of the following is **most** important to a successful budgeting effort?

- a) Experienced analysts
- b) Integrated budget software
- c) Reliable forecasts and trend analysis
- d) Top management support

(ICMA 2010)

## Budget Methodologies

### The Budgeting Cycle

The budgeting cycle is a process that goes on throughout the year, even though the budget is probably completed before the year begins. The budgeting cycle consists of more than just the development of the annual profit plan, although that is a big part of the cycle. Throughout the budget year, actual results need to be compared with planned results and variances investigated. Without this comparison and investigation, the budgeting cycle loses much of its usefulness to the company. The process includes:

- Using data from past performance as well as future expectations, managers at all levels in the organization work together to plan the performance of the company as a whole for the next budget period. Management accountants are involved in this planning, as well. The result is the annual master budget or profit plan for the coming period.
- Throughout the period, actual results are reported on and compared with budgeted results on a monthly or quarterly basis.
- Management accountants assist managers in investigating the variances from the plan. If necessary, operational changes are made. If the budget cannot be achieved because of some external situation that has developed, the budget itself may need to be revised.
- Throughout the period, managers and management accountants monitor market feedback, external conditions, and actual results as they plan for the next budget period. For example, if a sales decline occurs, managers may plan changes to the product line for the next period.

### Budget/Profit Planning Manual

The budget or profit-planning manual details the budgeting process. It is written and maintained by the department in charge of coordinating the development of the profit plan and it is their guidebook for the whole budget development process. It outlines what needs to be done and when. The manual contains:

- A list of the monthly or quarterly reports that are to be distributed to managers throughout the year, showing variances between actual results and the plan and the distribution list for each report.
- The process for developing the annual profit plan, including:
  - Meeting with top management to get their guidelines and forecasts for the coming budget period.
  - Instructions for meetings to be held with department heads to communicate the guidelines and to train them in developing their individual department budgets. The support of top management is essential to gain cooperation from department heads. To help achieve this cooperation from

department heads, meeting announcements should come from top management, not from the profit planning department.

- Information about budget forms to be sent out for department heads to complete and return. The budget manual will include information about which general ledger accounts are to be included on each form, to whom the forms should be sent in each department, how the forms are to be completed, and which information from one department's budget is needed for another department's budget.
- Instructions for following up with department heads to get completed budget forms submitted by the required dates.
- When forms are received from department heads, instructions on which departments' budgetary data needs to be sent to other departments to use in their budgets.
- Instructions are included on how to compile all of the individual budgets into a consolidated profit plan for presentation to top management. This is the first draft of the profit plan, and top management will give input as to changes needed.
- After top management has provided its input, the manual contains instructions for communicating the required changes to the department heads in order to revise their individual budgets. This communication to department heads should come from top management, but the changes need to be returned to the profit planning department.
- Instructions for re-sending revised budgets as received from department heads to those departments that need them to complete their revisions and for re-consolidating the revised budgetary input and for resubmitting the consolidated second draft to management. This process goes on until top management approves the consolidated profit plan.

The budget/profit planning manual needs to be kept up to date because circumstances and personnel can change. The process of the budget cycle is complex, and an up-to-date manual is necessary to insure that proper procedures will be followed even if personnel change.

As you can see, one of the most important parts of the budget manual is the **communication and distribution** process. There is an order in which the budgets need to be developed, because information from one department's budget is needed input to another budget. For example, the sales budget is needed by the production department in order to develop the production budget. As one budget is completed, it must be sent to all of the departments whose budgets are based on that budget or which use the budgeted information in their own budgets.

A **planning calendar** is used by the profit planning department along with the budget manual. This is the document that sets forth all of the deadlines, policies, and procedures of the budgeting process. With a calendar like this, a firm greatly enhances its chances of having the budgeting system work as it is supposed to.

Question 61: Which one of the following best describes the role of top management in the budgeting process? Top management:

- a) Should be involved only in the approval process.
- b) Lacks the detailed knowledge of the daily operations and should limit its involvement.
- c) Needs to be involved, including using the budget process to communicate goals.
- d) Needs to separate the budgeting process and the business planning process into two separate processes.

(CMA Adapted)

Question 62: The budgeting process should be one that motivates managers and employees to work toward organizational goals. Which one of the following is least likely to motivate managers?

- a) Participation by subordinates in the budgetary process.
- b) Having top management set budget levels.
- c) Use of management by exception.
- d) Holding subordinates accountable for the items they control.

(CMA Adapted)

## The Annual/Master Budget or Profit Plan

The development of an annual profit plan for a large corporation may take many months to complete because the annual profit plan is made up of several different budgets, and some budgets cannot be developed until other budgets have already been completed. For example, the sales budget will be the driving factor in determining how many units must be produced, and therefore the sales budget must be completed before the production budget can be completed.

One of the most important things that can be done in the process of developing the profit plan is involving all of the correct people. This is not a process to be undertaken exclusively by upper management or during board meetings. Lower-level managers need to be involved because they know what is possible, what is not possible, and what resources are required to meet a specific level of activity.

This method of **participative budgeting** has a number of benefits for the organization. When the people responsible for fulfilling the budget are involved in the process of developing it, they will be more likely to support and accept the budget and be more motivated to meet it. In addition, the accuracy of the budget will be increased because of the input from the people who are actually involved in the process being budgeted.

Similar in concept to participative budgeting is **bottom-up budgeting**. This is the system in which the budget is developed by starting at the lowest levels in the operations systems and building revenues and costs from there.

**Upper management** still needs to be involved in the planning and budgeting process. They will **set the goals, establish the priorities and provide the necessary support** to make sure the process is completed correctly.

## The Master Budget

The master budget is the culmination and the goal of the budgeting process. The master budget is also called the **comprehensive budget**. The master budget is a summarized set of budgeted financial statements, including the **budgeted balance sheet, budgeted income statement, and budgeted statement of cash flows**.

A projected financial statement can be called a **pro forma financial statement**; however, the master budget is not a pro forma financial statement. The term **pro forma** is used to refer to a forecasted financial statement prepared for a specific purpose (for example, to do "what if" analysis in the process of planning). A company might prepare many different sets of pro forma financial statements for the same period in its planning process. A pro forma financial statement is not used for formal variance reporting as the master budget and the flexible budget<sup>30</sup> are. However, if an action that was forecasted is implemented, the company would probably want to compare the actual results with the forecasted, pro forma ones. But pro forma

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<sup>30</sup> A **flexible budget** is a budget that is prepared using **budgeted** variable revenues and costs per unit multiplied by the **actual** level of activity. It is essentially what the budget would have been if the company had known what the actual level of activity would be when it developed the budget.

financial statements are not a part of the formal budgeting process. They are used for planning and decision-making purposes, and the amounts in them may be quite different from the amounts in the master budget. (Planning and the use of pro forma financial statements is discussed more in the topic of Top-Level Planning and Analysis in this section.)

The master budget is prepared for just one planned activity level, and the activity level is whatever is projected before the period begins. When flexible budgeting is used, the flexible budget is also prepared for just one activity level, but that activity level is the **actual** activity level achieved during the period. Therefore, the flexible budget amounts cannot be finalized for a reporting period (usually a month at a time) until the period is past and the actual achieved activity level for that period is known. (The master budget and the flexible budget will be discussed in detail in the section on Budget Methodologies.)

**Note:** The term **activity level** or **level of activity** is used in planning and budgeting to refer to various activities. It is often used to mean the planned number of units the company expects to produce or the planned number of direct labor or machine hours the company expects to use. It can also refer to a planned sales volume or any other planned volume.

The master budget is created using both non-financial and financial assumptions, which come about as a result of the planning process. For instance, companies develop budgets for the number of units of each product that they expect to manufacture and sell, the number of employees they will need, and so forth. The master budget is a result of both **operating decisions** and **financing decisions**. Operating decisions are concerned with the best use of the company's limited resources. Financing decisions are concerned with obtaining the funds to acquire the resources the company needs.

A profit plan that is broken down according to departmental lines will provide more feedback and will function as more of a control tool than one that is not departmentalized, because each department manager will be responsible for meeting his or her department's profit plan. Ideally, each department manager will also be responsible for developing his or her department's profit plan. These underlying budgets are used in developing the master budget. The master budget is the **consolidation** of all the departmental budgets. It comprises operating budgets and financial budgets.

**Operating budgets** are used to identify the resources that will be needed to carry out the planned activities during the budget period, such as sales, services, production, purchasing, marketing, and R&D (research and development). The operating budgets for individual units are compiled into the budgeted income statement.

**Financial budgets** identify the sources and uses of funds for the budgeted operations. Financial budgets include the cash budget, budgeted statement of cash flows, budgeted balance sheet, and the capital expenditures budget.

## Development of the Master Budget

The master budget consists of two classifications: the **operating budget** and the **financial budget**.

### The Operating Budget

The operating budget includes the **income statement and all the budgets that support it**, which will be detailed in the following pages, including:

- Sales budget
- Production budget
- Direct materials usage budget
- Direct materials purchases budget
- Direct labor budget
- Manufacturing overhead costs budget

- Ending inventories budget (finished goods and direct materials)
- Cost of goods sold budget
- Nonmanufacturing budget

### The Financial Budget

The financial budget includes:

- Capital expenditures budget
- Cash budget
- Budgeted balance sheet
- Budgeted statement of cash flows

### The Capital Expenditures Budget

**The capital expenditures budget is not a part of the annual budget development process**, but it is very important to the development of the annual budget.

Unlike the other budgets, the capital budget usually covers a period of several years and thus is often **prepared years in advance** of the budget year it affects. However, it is mentioned first because the capital expenditures budget must be in place for the period covering the budget year before the planning process can be completed, since the capital expenditures budget contains items that will need to be included in the income statement and the balance sheet for the budget year.

The capital expenditures budget is the **budget for long-term capital expenditures** such as property, plant, and equipment. Any capital expenditures to be made during the budget year will need to be included in the budgeting process for the year. Capital expenditures budgeted for the coming year will affect the budgeted balance sheet as increases in fixed assets and in accounts receivable, inventory, and accounts payable. They will affect the budgeted income statement as income expected from the new projects along with related expenses, including depreciation on the new equipment. Those effects on the income statement and the balance sheet will affect cash as well, so they will flow to the cash budget and the budgeted statement of cash flows.

The capital expenditures budget is prepared for several years at a time so that the company will be able to obtain the necessary financing or accumulate the necessary cash to carry out its capital expansion plans. Thus, the capital budget covers multiple planning periods.

Capital expenditures are generally budgeted as separate projects covering several years each. Each project is analyzed separately to determine whether it is acceptable for the company. (This analysis is covered in the Capital Budgeting section of the CMA exams, currently in the Part 2 exam, so it will not be explained in detail here. However, for this exam, you may need to be able to determine the capital expenditures budget for a single period, based upon approved projects that will affect the upcoming planning period.)

The capital expenditures budget consists of a list of each major project that has been approved and the amount to be funded for the coming year. The annual amount for each project is then broken down according to the quarter(s) or possibly month(s) when the expenditures for each project are expected to occur. The quarterly or monthly totals of cash funding requirements for all projects will be used in preparing the cash budget as well as the budgeted balance sheet. Any anticipated financing must also be included in the cash budget and the budgeted balance sheet. The budgeted balance sheet must reflect the investments and the financing, and the budgeted income and cash flow statements must reflect any net income planned for the coming period.

The depreciable life for each asset to be purchased is also shown on the capital expenditures budget, because it will be needed to calculate the budgeted depreciation expense for the budgeted income statement as well as accumulated depreciation amounts for the budgeted balance sheet.

Senior management must communicate information about planned capital projects for the year to the department heads who will be developing the operating budgets so that they can incorporate the effects of the planned capital projects into their budgets for the year.

## The Operating Budget

The operating budget is the **budgeted income statement** and all the individual budgets that feed into it. We will take a look here at the individual budgets and what each is prepared for, as well as the order in which they are prepared.

**Note:** For the Exam, you may need to know the order in which the different budgets are prepared. Some of the questions may be based on the order of preparation. As you will see below, it is critical **to produce the sales budget first** so that the company knows how many units will need to be produced or purchased.

As we talk about the various operating budgets, you will have examples to look at. For each budget example, we will use annual amounts for simplicity's sake. However, in a real situation, the budget would be developed using monthly figures or at least quarterly figures, so that actual results for the year-to-date can be compared with planned results for the year-to-date as the coming year goes on. The monthly or quarterly amounts are needed in order to develop the cash budget, as well. These monthly or quarterly figures should not be the same for every month or quarter; that is, they should not be annual amounts simply divided by twelve or by four. Seasonal changes and other expected variations in activity should be taken into consideration.

### 1. Sales Budget

The sales budget shows the expected sales in units of each product and each product's expected selling price. The sales budget is based upon the firm's forecasted sales level, its short- and long-term objectives, and its production capacity.

**The first operating budget to be prepared is always the sales budget**, because the production budget and all the other budgets for the company are derived from the sales budget. If sales are expected to be low, the company does not need as much inventory or as many sales people, and so on. On the other hand, if sales are expected to be high, more of each of these resources will be required.

The sales budgets should be developed for each department individually or possibly for each sales person, depending upon the nature of the business. Additionally, the sales budget needs to be based on realistic estimates of sales, since this budget will be the driver behind all of the remaining budgets. If the sales budget is too optimistic, production will be too high, inventory will be too high, and problems such as cash shortfall will result. If the sales budget is too low, production and inventory will be too low, and sales will be lost because of a lack of product to sell.

The sales budget is probably the **most difficult to produce** because it relies entirely on information and estimations that are outside of the direct control of the company. The company has no direct control over the economy as a whole or over competitors and technological advances that may make the company's product obsolete.

If demand is greater than the company's production capacity, however, the sales budget should not reflect the amount the company **could** sell if it were able to increase production. It will have to be adjusted to the quantity that **will be available** to be sold.

The sales budget will need to incorporate information about sales revenues expected from any capital projects that are expected to begin generating sales during the coming year.

**Note:** One more item that needs to be considered in the sales budget is the level of credit sales and when those credit sales will be collected. Though the timing of collections is not critical for the sales budget itself, the amount of collections is critical for the development of the cash budget (covered later).



**Example: Sales budget** for the year ending December 31, 20X3 for Wood Creations, a manufacturer of three products:

<u>Product</u>	<u>Budgeted Sales in Units</u>	<u>Selling Price</u>	<u>Total Sales Revenues</u>
Wood birdhouses	4,000	\$ 50	\$ 200,000
Wood garden benches	2,500	275	687,500
Wood bowls	3,500	60	<u>210,000</u>
Total Sales Revenue			<u>\$1,097,500</u>

The budgeted sales revenue in the master budget will be \$1,097,500. The production department will use the information about how many units of each product the sales department plans to sell in developing its budget.

## 2. Production Budget

After determining the sales budget, the production budget is developed so that it incorporates the company's sales budget along with its capacity and inventory objectives. If the company would like to increase its inventory, it will need to include this in its production plans. Similarly, if the company wants to decrease inventory, it will need to produce fewer units than it plans to sell. The final determination of how many units to produce during the period is done in the **production budget**.

The production budget will of course need to include production from any new capital projects planned to begin production during the year.

The production budget also includes **when** the units will be produced. The units must be produced prior to the time when they will be sold. If sales are expected in the early part of the year, production needs to be done early. If sales are expected to be later in the year, production needs to take place later in the year or the company will need to pay significant storage costs.

**Note:** If the prices of the inputs to the product are expected to change significantly in the future, the changes must also be taken into account in determining when and how many units to produce. As much as possible, the company will want to purchase inputs to produce its products when the prices of the inputs are lower rather than higher.

**Example: Production budget** for the year ending December 31, 20X3 for Wood Creations.

The company expects to end 20X2 (the current year) with 300 birdhouses, 200 benches, and 300 bowls on hand in finished goods inventory. The company wants to increase its finished goods inventory levels to 350 birdhouses, 250 benches, and 350 bowls at year-end 20X3.

	<u>Birdhouses</u>	<u>Benches</u>	<u>Bowls</u>
Budgeted sales in units	4,000	2,500	3,500
Plus: Ending finished goods inventory required	<u>350</u>	<u>250</u>	<u>350</u>
Total units required	4,350	2,750	3,850
Minus: Beginning finished goods inventory	<u>300</u>	<u>200</u>	<u>300</u>
Finished goods units to be produced	<u>4,050</u>	<u>2,550</u>	<u>3,550</u>



The production budget in number of units to be produced provides the foundation for the development of the following four budgets:

- 1) **Direct materials usage budget.**
- 2) **Direct materials purchases budget**, which is created in much the same way as the production budget, taking into account the desired change in inventory of raw materials.
- 3) **Direct labor costs budget.**
- 4) **Factory overhead budget**, including both variable costs (such as utilities) and fixed costs (such as supervisory salaries). Fixed factory overhead costs that fall within the relevant range do not change as production levels change, but if the budgeted production is outside the relevant range, appropriate adjustments need to be made to fixed manufacturing costs.

The direct materials usage and purchases budgets, direct labor budget, and factory overhead budget feed into the ending inventories budget, and all of these individual budgets feed into the cost of goods sold budget.

Because all of these budgets are interrelated, a change in one budget will require a change in another budget or budgets. As the level of production changes, the amount of labor and material required will change. As the amount of labor changes, there may need to be a change as well in **indirect materials** and **indirect labor**, both of which are overhead costs.

Indirect materials are materials used in the manufacturing process, but their costs are not directly traceable to any particular product. Indirect labor is likewise not directly traceable to any particular product. An example of indirect labor would be the wages of a janitor who cleans up the plant, since his wages cannot be traced to any one product. As these items change, changes will be required in the overhead budget.

Because of the way the individual budgets are connected to each other, a change in one budget will almost always affect at least one other budget.

**Note:** In accounting for production, costs for direct materials, labor, and overhead are applied to each unit as it is produced. Almost always, the costs that are applied to each unit are the **budgeted** costs allowed for each unit rather than the actual costs incurred. Use of actual costs would be impractical, primarily because many actual costs are not known until after the reporting period has ended. The cost accountants need to be able to account for each unit as it is produced, so they use the budgeted costs, also called standard costs.

Usually, the amount of overhead cost applied to each unit is based on the number of direct labor hours or the number of machine hours allowed for the production of each unit and the cost is expressed as a cost per direct labor or machine hour. Thus, the amount of overhead cost applied to each unit is the budgeted (standard) cost per hour multiplied by the number of hours allowed for production of one unit.

After the period is completed and the actual costs are known, the differences between the actual, incurred costs and the budgeted costs applied to production (called variances) are calculated and resolved, usually in one of two ways:

- 1) They are pro-rated between finished goods inventory, work-in-process inventory, cost of goods sold and (for direct materials variances only) direct materials inventory on the basis of the period's production costs in each, or
- 2) They are closed out 100% to cost of goods sold.

Direct materials, direct labor, and overhead costs are all handled in this manner.

**The method a company uses to resolve variances is always important information to note in an exam problem, because it will affect the balances in inventories and cost of goods sold.**

The calculation of variances is covered in detail in Section C, and accounting for units produced is covered in detail in Section D.

## 2A. Direct Materials Usage Budget

The number of units to be produced (from the production budget) is used to calculate the amount of direct materials required and their cost. The quantities of direct materials to be used depend upon how efficient the production employees are in assembling them into finished products as well as the quality of the direct materials purchased.

For each product, the company has a **bill of materials** that specifies which materials and how much of each are to be used in manufacturing the product, the sequence in which they are to be used, and in what department each process is to be completed. Those bills of materials are used to develop the direct materials usage budget.

The direct materials usage budget will be affected by production needs created by any new capital projects planned to begin production during the year.

**Example: Direct materials usage budget** for the year ending December 31, 20X3 for Wood Creations.

Direct materials required to produce one birdhouse: 1.5 board feet of  $\frac{3}{8}$ " oak, cost \$10 per ft.

Direct materials required to produce one garden bench: 9 board feet of  $\frac{1}{2}$ " oak, cost \$12 per ft.

Direct materials required to produce one bowl: 0.5 board feet of 3" oak, cost \$20 per ft.

All direct material costs are expected to be the same for 20X3 as they have been for 20X2.

The company's beginning direct materials inventory is planned to be 170 board feet of  $\frac{3}{8}$ " oak, 1,000 board feet of  $\frac{1}{2}$ " oak, and 75 board feet of 3" oak. The company wants to end the year with 200 board feet of  $\frac{3}{8}$ ", 1,100 board feet of  $\frac{1}{2}$ ", and 100 board feet of 3" oak.

### Physical Units Budget:

	<u><math>\frac{3}{8}</math>"</u>	<u><math>\frac{1}{2}</math>"</u>	<u>3"</u>	<u>Total</u>
DM for birdhouses: 4,050 × 1.5 board feet	6,075			
DM for benches: 2,550 units × 9 board feet		22,950		
DM for bowls: 3,550 units × 0.5 board feet			1,775	
<b>Total quantity of direct materials to be used</b>	<b>6,075</b>	<b>22,950</b>	<b>1,775</b>	

### Cost Budget:

Available from beginning materials inventory:

$\frac{3}{8}$ " : 170 board ft. × \$10	\$ 1,700			
$\frac{1}{2}$ " : 1,000 board ft. × \$12		\$ 12,000		
3" : 75 board ft. × \$20			\$ 1,500	
Plus - To be purchased this period:				
$\frac{3}{8}$ " : (6,075 – 170 on hand) × \$10	59,050			
$\frac{1}{2}$ " : (22,950 – 1,000 on hand) × \$12		263,400		
3" : (1,775 – 75 on hand) × \$20			34,000	
<b>Total cost of direct materials to be used<sup>1</sup></b>	<b><u>\$60,750</u></b>	<b><u>\$275,400</u></b>	<b><u>\$35,500</u></b>	<b><u>\$371,650</u></b>

<sup>1</sup> Note that the total cost of direct materials used does not include any adjustment for desired ending direct materials inventory. See next example for that calculation.

## 2B. Direct Material Purchases Budget

The Purchasing Department can now prepare the direct material purchases budget. The direct material purchases budget is derived from the direct material usage budget. Like the overall production budget, the amount of direct materials to be used in production is adjusted by the amount of change from beginning to ending materials inventory to determine the quantity of each material to be purchased, and then the costs for those quantities are determined.

The direct materials purchases budget will also be affected by production needs created by any new capital projects planned to begin production during the year.

**Example: Direct material purchases budget** for the year ending December 31, 20X3 for Wood Creations.

	<u>3/8"</u>	<u>1/2"</u>	<u>3"</u>	<u>Total</u>
Physical units:				
To be used in production	6,075	22,950	1,775	
Plus: Desired ending direct materials inventory	<u>200</u>	<u>1,100</u>	<u>100</u>	
Total required	6,275	24,050	1,875	
Minus: Beginning direct materials inventory	<u>170</u>	<u>1,000</u>	<u>75</u>	
<b>Purchases</b>	<b>6,105</b>	<b>23,050</b>	<b>1,800</b>	
Costs:				
3/8" oak: 6,105 board ft. × \$10	\$61,050			
1/2" oak: 23,050 board ft. × \$12		\$276,600		
3" oak: 1,800 board ft. × \$20			<u>\$36,000</u>	
<b>Total cost of direct materials purchases</b>	<b><u>\$61,050</u></b>	<b><u>\$276,600</u></b>	<b><u>\$36,000</u></b>	<b><u>\$373,650</u></b>

## 2C. Direct Labor Budget

The direct labor budget is developed using direct labor standards – the time allowed per unit of output and the cost per hour of direct labor time – to calculate the budgeted cost for direct labor. The cost per hour of direct labor time will generally include wages and all other employee costs. These other costs include employer contributions to Social Security (FICA) and Medicare, workers' compensation insurance for workers who are hurt on the job, federal and state unemployment taxes paid by the employer, health and life insurance premiums if they are provided, pension plan contributions paid by the company, and any other employee benefits. These may all be presented in an **Employee Benefit Statement**.

Although some employee-related costs are fixed costs, many employee-related costs vary directly with salary costs, making them a type of variable cost. Variable amounts include the employer's portion of the social security contribution (up to a certain maximum per year, at which point the social security contribution is no longer paid), employer's portion of Medicare, workers' compensation insurance, and unemployment compensation taxes. Pension plan contributions may be a simple percentage if the plan is a defined contribution plan, or they may be a much more complex calculation if the plan is a defined benefit plan. Either way, pension plan contributions will be variable. Insurance premiums vary with the number of employees covered and may also vary with the employees' salary levels.

Most companies do not try to project employee-related costs exactly. It would be too time-consuming and the benefit gained from a little more accuracy is not worth the cost. Instead, they develop a factor that is a weighted average cost and apply that factor to the total budgeted salaries and wages for a given employee group to calculate the budgeted employee-related costs. To develop that factor, companies need to analyze historical employee-related costs as a percentage of salaries and wages.

**Note:** The company may choose to treat the costs of employee benefits as an overhead and allocate them to the units produced in that way (both actual costs and for the budget) instead of including them with the hourly wages in the direct labor budget. The method in which these costs are treated may have a small effect on cost of goods sold, income, or inventory. Only in cases where direct labor is a large portion of the total expenses will this difference be significant.

The direct labor budget will also be affected by production needs created by any new capital projects scheduled to begin production during the coming year.

The direct labor budget may also be influenced by outside parties, especially labor unions. As labor contracts are completed and new contracts signed, this may cause an immediate change in the cost of direct labor. Additionally, any changes in the level of skill that is required of the labor force as a result of changing production technologies will also impact the direct labor budget.

The company usually prepares several direct labor budgets, one for each type of labor used for production.

**Example: Direct labor budget** for the year ending December 31, 20X3 for Wood Creations. Wood Creations has only one direct labor hourly rate: \$20 per hour. The direct labor time standards are:

	<u>Birdhouses</u>	<u>Benches</u>	<u>Bowls</u>
Direct labor hours	0.6	2	1

Thus, the direct labor costs budget is as follows:

	<u>Units Produced<sup>1</sup></u>	<u>Standard Hrs./Unit</u>	<u>Total Hours</u>	<u>Hourly Rate</u>	<u>Total Cost</u>
Birdhouses	4,050	0.6	2,430	\$20	\$ 48,600
Garden benches	2,550	2.0	5,100	20	102,000
Bowls	3,550	1.0	<u>3,550</u>	20	<u>71,000</u>
<b>Totals</b>			<b><u>11,080</u></b>		<b><u>\$221,600</u></b>

<sup>1</sup> From Production Budget.

## 2D. Manufacturing Overhead Costs Budget

The traditional method of applying overhead costs to units produced uses either machine hours or direct labor hours allowed per unit of output as the basis of the allocation. The budgeted total fixed overhead costs are determined and the budgeted total variable overhead costs are determined. Those totals are divided by the number of hours (machine or labor) budgeted to find the fixed and variable costs per hour allowed for the budgeted output, and the result is the standard overhead cost per hour.

**Example: Manufacturing overhead costs budget** for the year ending December 31, 20X3 for Wood Creations.

Wood Creations allocates manufacturing overhead on the basis of direct labor hours. Here are the total fixed and variable costs budgeted:

Fixed costs for capacity of 11,080 direct labor hours:

Depreciation	\$ 2,240	
Supervisory salaries and employee costs	30,000	
Other indirect fixed costs	<u>1,000</u>	\$33,240

Variable costs:

Indirect manufacturing labor	\$13,960	
Equipment maintenance	5,000	
Supplies	<u>3,200</u>	<u>22,160</u>

**Total manufacturing overhead costs** **\$55,400**

The standard overhead rates per direct labor hour are:

Fixed overhead: \$33,240 budgeted ÷ 11,080 direct labor hours budgeted = \$3/DLH  
 Variable overhead: \$22,160 budgeted ÷ 11,080 direct labor hours budgeted = \$2/DLH  
 Total overhead: \$55,400 budgeted ÷ 11,080 direct labor hours budgeted = \$5/DLH

### 3. Ending Inventories (FG and DM) Budget

The next budget to be prepared is the budget for ending inventories, both finished goods inventory and direct materials inventory. The overhead costs are treated as inventoriable product costs, so total overhead costs will be allocated to production at the rate of \$5 per direct labor hour allowed for each unit planned (which was calculated in the manufacturing overhead costs budget).

**Example: Ending inventories budgets** for the year ending December 31, 20X3 for Wood Creations.

#### Finished Goods Inventory cost per unit:

	<u>Birdhouses</u>	<u>Benches</u>	<u>Bowls</u>
Direct materials:			
$\frac{3}{8}$ " oak: 1.5 board ft. per unit $\times$ \$10	\$15		
$\frac{1}{2}$ " oak: 9 board ft. per unit $\times$ \$12		\$108	
3" oak: 0.5 board ft. per unit $\times$ \$20			\$10
Direct labor:			
Birdhouses: 0.6 hours $\times$ \$20	12		
Benches: 2 hours $\times$ \$20		40	
Bowls: 1 hours $\times$ \$20			20
Manufacturing overhead:			
Birdhouses: 0.6 hours $\times$ \$5	3		
Benches: 2 hours $\times$ \$5		10	
Bowls: 1 hour $\times$ \$5			5
<b>Total cost per unit</b>	<b><u>\$30</u></b>	<b><u>\$158</u></b>	<b><u>\$35</u></b>

Wood Creations uses the **first-in-first-out (FIFO) cost flow assumption**. Therefore, the costs per unit calculated above will be used to calculate the cost of the budgeted ending finished goods inventory.

#### Budgeted Ending Inventories (Direct Materials and Finished Goods):

	<u>Quantity</u>	<u>Cost per Unit</u>	<u>Extended Cost</u>	<u>Total</u>
Direct materials:				
$\frac{3}{8}$ " boards	200	\$ 10	\$ 2,000	
$\frac{1}{2}$ " boards	1,100	12	13,200	
3" boards	100	20	<u>2,000</u>	\$17,200
Finished goods:				
Birdhouses	350	\$ 30	\$10,500	
Benches	250	158	39,500	
Bowls	350	35	<u>12,250</u>	<u>62,250</u>
<b>Total ending inventories</b>				<b><u>\$79,450</u></b>

#### 4. Cost of Goods Sold Budget

After all of the production related budgets are completed, the company can produce the **cost of goods sold budget**, which is based on the calculation of cost of goods sold, as follows:

Beginning Inventory <sup>31</sup>	
+ Expected Budgeted Purchases or Production	
= Expected Goods Available for Sale	
– Desired Ending Inventory	
= <b><u>Budgeted Cost of Goods Sold</u></b>	

**Example: Cost of goods sold budget** for the year ending December 31, 20X3 for Wood Creations.

The cost of Wood Creations' **beginning inventory** of finished goods is:

	<u>Quantity<sup>1</sup></u>	<u>Cost per Unit<sup>2</sup></u>	<u>Extended Cost</u>	<u>Total</u>
Birdhouses	300	\$ 28	\$ 8,400	
Benches	200	150	30,000	
Bowls	300	33	<u>9,900</u>	\$ 48,300

The expected **budgeted production** cost is

	<u>Quantity<sup>1</sup></u>	<u>Cost per Unit<sup>3</sup></u>	<u>Extended Cost</u>	<u>Total</u>
Birdhouses	4,050	\$ 30	\$121,500	
Benches	2,550	158	402,900	
Bowls	3,550	35	<u>124,250</u>	\$648,650

The cost of Wood Creations' **desired ending inventory** (from the ending inventories budget) is

	<u>Quantity<sup>1</sup></u>	<u>Cost per Unit<sup>3</sup></u>	<u>Extended Cost</u>	<u>Total</u>
Birdhouses	350	\$ 30	\$10,500	
Benches	250	158	39,500	
Bowls	350	35	<u>12,250</u>	\$ 62,250

The **cost of goods sold budget** is:

Beginning Inventory	\$ 48,300
+ Expected Budgeted Production	<u>648,650</u>
= Expected Goods Available for Sale	\$696,950
– Desired Ending Inventory	<u>62,250</u>
= <b>Budgeted Cost of Goods Sold</b>	<b><u>\$634,700</u></b>

<sup>1</sup> The quantity comes from the production budget.

<sup>2</sup> Cost per unit for the 20X3 beginning inventory (the same as the current year's ending inventory) is different from the cost per unit for the 20X3 production and 20X3 ending inventory because the current year's direct labor and overhead costs were different from the budgeted amounts for the coming year. Cost per unit for the beginning inventory is simply given here and cannot be calculated from any other information given in this extended example.

<sup>3</sup> Budgeted production cost per unit comes from the Ending Inventories – Finished Goods Inventory cost per unit budget.

<sup>31</sup> The budget for the coming year is developed prior to the end of the current year. Therefore, this beginning inventory figure will be the projected ending inventory at the end of the current year.

## 5. Nonmanufacturing Budgets

Amounts for nonmanufacturing costs come from the various areas of the company that are not involved in production. Those budgets include:

- Research and development (R&D) budget.
- Selling, marketing and distribution budget, including sales supervisory salaries, sales commissions, selling expenses (such as travel and entertainment), advertising and promotion expenses, shipping-out expenses, telephone and wireless, office supplies, depreciation on office furniture and equipment used by sales and marketing personnel, and so forth.
- Administrative and general expense budget, including salaries and wages for management and support staff in administrative and staff departments (i.e., accounting, legal, IT, human resources), travel and entertainment, insurance, audit fees, telephone and wireless, office supplies, depreciation on office furniture and equipment used by administrative personnel, and so forth.
- Budgets for other expenses or sources of revenue such as interest income and interest expense.

**Note:** Each of the individual budgets prepared for expenses should be broken down into variable and fixed costs. This breakdown is significant because fixed costs cannot be changed. The breakdown is necessary in order to develop a flexible budget as well, since in a flexible budget variable items are adjusted to their equivalent values using actual activity while fixed items are unchanged. Also, the budgeted variable costs (particularly for overhead and selling and administration) are needed to determine the budgeted contribution margin from each business unit. The **contribution margin** is total revenue minus variable expenses.

The nonmanufacturing budgets need to be developed in enough detail to be useful. The assumptions underlying the amounts in them should be documented for reference. When the first drafts of the budgets are revised, those documented assumptions will be needed in order to determine where changes can be made. For example, the budgeted employees and their salaries underlying the budgeted salaries and wages amount should be documented. If it is necessary to revise and cut budgeted salaries and wages, it will be much easier to make that revision if detail is available about the salaries and wages used to develop the first draft of the budget.

After the operating budget is completed, the company can evaluate the expected profit for the upcoming period. This evaluation may be done using earnings per share, an industry average, or a price-earnings ratio.

In addition, the budgeted net income becomes a part of the budgeted balance sheet through its effect on retained earnings in the equity section.

## The Financial Budget

The financial budget is the other major classification within the master budget. It includes the capital expenditures budget, the cash budget, the budgeted balance sheet, and the budgeted statement of cash flows.

We have already talked about the capital expenditures budget, since it must be in place for the budget year before any other budgets can be developed.

### The Cash Budget

The cash budget (also called the cash management, cash flow or working capital budget) draws upon information from all other budgets. Because it uses information from the other budgets, it is **the last budget prepared**. It is also one of the most important budgets developed. The cash budget tracks the inflows and outflows of cash on a month-by-month (possibly even week-by-week or day-by-day) basis.

The cash budget is similar to but not exactly the same as a budgeted statement of cash flows. The cash budget must be prepared **before** the planned balance sheet can be prepared. On the other hand, the budgeted statement of cash flows is prepared **after** the planned balance sheet and income statement are



prepared. The cash flows in the budgeted statement of cash flows are segregated according to operating, investing, and financing cash flows and the cash flows are presented as net amounts. In contrast, the cash flows in the cash budget are segregated according to receipts and disbursements.

The cash budget shows the planned sources and uses of cash for the budget period. The various budgets prepared up to this point provide the information for the cash budget. For example, the capital expenditures budget provides information on planned equipment purchases. The sales budget provides the information needed to determine budgeted collection of accounts receivable. The direct material purchases, direct labor, and the nonmanufacturing costs budgets provide the information needed for budgeted cash disbursements. The ending cash balance appears on the budgeted balance sheet for the period end.

If the cash budget is accurate, it will allow the company to plan for any cash shortfalls that may occur during the year and also enable the company to plan for any excess cash that may accumulate during the year. Any excess cash should be invested for the time period that it will not be needed.

One advantage of predicting cash shortfalls is that it will be easier (and less expensive) for the company to obtain a loan if it is aware of its need before the shortfall arrives and if it is able to present cash inflow and outflow projections to the bank to support its loan request. The company also would have more time to obtain permanent capital from equity sources by selling shares if that is the best alternative.

**Note:** Although all companies should prepare a cash budget, it is particularly important for those that operate as **seasonal businesses**. In addition, for a seasonal business, production, sales, and ending inventory **by month** are also critical budgets.

We will not attempt to give a numerical example of Wood Creations' cash budget here. We would need much more detail than we have regarding monthly or quarterly amounts budgeted for sales revenue, production costs, and nonmanufacturing items in order to develop appropriate cash receipts and cash disbursements budget amounts. You will find several problems at the end of this topic and in ExamSuccess that will give you practice in developing budgeted cash receipts and cash disbursements for a month or a quarter.

A format for a cash budget is presented on the next page.

The following is the format of a cash budget. This format assumes the budgeting is done by quarter, but a monthly budget would be even better, with columns for each month.

<b>Cash Budget for the Year Ending December 31, 20X3</b>					
	<b>Quarters</b>				<b>Year as a Whole</b>
	<b>Q1</b>	<b>Q2</b>	<b>Q3</b>	<b>Q4</b>	
Cash balance, beginning	\$	\$	\$	\$	\$
Plus receipts:					
Collections from customers					
Sale of capital equipment					
Total cash available					
Minus disbursements:					
Direct materials					
Payroll					
Manufacturing overhead costs					
Nonmanufacturing costs					
Capital equipment purchases					
Income taxes					
Total disbursements					
Minimum cash balance desired					
Total cash needed					
Cash excess (deficit)	\$	\$	\$	\$	\$
Financing:					
Beginning borrowings	\$	\$	\$	\$	\$
Repayment(s) during period					
Interest expense					
Total effects of financing	\$	\$	\$	\$	\$
Cash balance, ending	\$	\$	\$	\$	\$

Question 63: Holland Company is in the process of projecting its cash position at the end of the second quarter. Shown below is pertinent information from Holland's records.

Cash balance at end of 1 <sup>st</sup> quarter	\$ 36,000
Cash collections from customers for 2 <sup>nd</sup> quarter	1,300,000
Accounts payable at end of 1 <sup>st</sup> quarter	100,000
Accounts payable at end of 2 <sup>nd</sup> quarter	75,000
All 2 <sup>nd</sup> quarter costs and expenses (accrual basis)	1,200,000
Depreciation (accrued expense included above)	60,000
Purchases of equipment (for cash)	50,000
Gain on sale of asset (for cash)	5,000
Net book value of asset sold	35,000
Repayment of notes payable	66,000

From the data above, determine Holland's projected cash balance at the end of the second quarter.

- a) Zero
- b) \$25,000
- c) \$60,000
- d) \$95,000

(ICMA 2010)

### The Master Budget Financial Statements

Once the operating budgets and the cash budget have been prepared, the company can prepare its master budget financial statements. The individual budgets that make up the operating and financial budgets are compiled into a budgeted income statement, balance sheet, and statement of cash flows. All of the budgeted financial statements are interconnected in the same manner as the actual year-end financial statements.

The master budget is the document the company relies on as its operating plan as it carries out management's plans in order to achieve its goals and objectives. It is a summary of management's operating and financial plans for the period, expressed as a set of budgeted financial statements for the period that reflects the impact of the operating decisions and financing decisions to be made during the coming period.

Master budget financial statements (including the budgeted income statement, budgeted balance sheet, and budgeted statement of cash flows<sup>32</sup>) will probably be prepared for each month of the budget period, or at least for each quarter. Budgeted financial statements are very important because looking at the budgeted financial statements, particularly the cash flows for each month during the period, will enable the company to identify any potential problems before they develop.

Potential problems may relate to the company's existing loan agreements or restrictive covenants.<sup>33</sup> For example, if the organization can determine, based on preliminary planned financial statements, that it will be in violation of a loan covenant during the second quarter of the year, it will have time to take corrective actions to prevent the violation and to adjust the budget accordingly.

Also, if the company sees that it will not meet the expected (or desired) profits or other financial measures after the preparation of the master budget financial statements, it needs to go back and look at the plans for the year. This process of revision will probably take place several times until the resulting budgeted financial statements are the way senior management wants them to look. However, when this reconsideration takes place the company needs to be very careful to not perform unrealistic budgeting by making unattainable changes to the budgeted amounts.

Question 64: Which one of the following statements regarding selling and administrative budgets is most accurate?

- a) Selling and administrative budgets are usually optional.
- b) Selling and administrative budgets are fixed in nature.
- c) Selling and administrative budgets are difficult to allocate by month and are best presented as one number for the entire year.
- d) Selling and administrative budgets need to be detailed so that the key assumptions can be better understood.

(CMA Adapted)

<sup>32</sup> The budgeted Statement of Cash Flows is prepared after the budgeted income statement and balance sheet.

<sup>33</sup> Long-term debt usually involves requirements for the company to maintain certain ratios in its financial statements, and these requirements are called **covenants**. Covenants are part of most loan agreements. One example of a covenant is a requirement that the company maintain a certain current ratio, such as at least 2:1. If the company's current ratio falls below the required level, the company is technically in default on its debt even though it may be making every scheduled payment. Under such circumstances, the lender can legally demand payment of the entire loan balance immediately, which could force the company into bankruptcy. Therefore, it is very important that the company maintain compliance with its debt covenants.

Question 65: Which one of the following items should be done first when developing a comprehensive budget for a manufacturing company?

- a) Determination of the advertising budget.
- b) Development of the sales budget.
- c) Development of the cash budget.
- d) Preparation of a pro forma income statement.

(CMA Adapted)

Question 66: A large manufacturer's forecast of total sales revenue for a year is **least** likely to be influenced by

- a) the seasonal pattern of sales revenues throughout the year.
- b) anticipated interest rates and unemployment rates.
- c) expected shortages of key raw materials.
- d) input from sales personnel.

(ICMA 2010)

Question 67: In the budgeting and planning process for a firm, which one of the following should be completed first?

- a) Sales budget
- b) Financial budget
- c) Cost management plan
- d) Strategic plan

(ICMA 2010)

Question 68: In preparing a corporate master budget, which one of the following is **most** likely to be prepared last?

- a) Sales budget
- b) Cash budget
- c) Production budget
- d) Cost of Goods Sold budget

(ICMA 2010)

Question 69: In an organization that plans by using comprehensive budgeting, the master budget refers to

- a) a compilation of all the separate operational and financial budget schedules of the organization.
- b) the booklet containing budget guidelines, policies, and forms to use in the budgeting process.
- c) the current budget updated for operations for part of the current year.
- d) a budget of a not-for-profit organization after it is approved by the appropriate authoritative body.

(ICMA 2010)

## Flexible Budgets

When a company develops its budget for a future period, it does not know what its actual sales and production volumes will be during that period. Revenues and costs in the master budget are based on **forecasted** volumes. The master budget is a **static budget** because each item in it is developed for one specific activity level.<sup>34</sup> When variance reports are prepared that compare the actual results to the master budget, one of the causes for each variance will usually be that the actual volume achieved was different from the planned volume. Variances between actual results and master budget amounts are not very useful for the company because they do not let the company know how the actual results compared to what the results **should have been**, based on the actual level of sales.

Since variances due simply to volume variations are expected, it is more important to focus on variances caused by other factors. For example, a variance caused by an increase in the cost of direct labor above what is expected for the **actual** production level could signal a problem in production and should be investigated. But an increase in the cost of direct labor that is caused by increased production only—**not** by an increase in cost above the expected amount for the actual production level—is not a production problem.

A flexible budget is a budget that is prepared **after the actual level of activity is known**. A flexible budget for a production department will be adjusted to the actual volume of units produced. A flexible budget for an income statement will be adjusted to the actual volume of units sold.

The flexible budget is prepared for the actual level of activity using all of the standard variable costs per unit along with the standard total fixed cost as determined at the beginning of the year. Essentially, what the flexible budget does is answer the question, "If we had known what the actual level of activity was going to be when we prepared the budget, what would the budget have looked like?" In other words, the flexible budget is the budget that would have been prepared for the actual level of activity for the period.

**Note:** Another way of looking at the preparation of the flexible budget is this: after the budget process is complete and the master budget has been created (but before the actual sales results are known), the budgeting team creates a number of other budgets for different levels of sales. If, for example, the master budget projected 100,000 units of sales, the flexible budget process will create budgets for 85,000 units, 90,000 units, 95,000 units, 105,000 units, 110,000 units, and 115,000 units. At the end of the year, the actual results are compared to the flexible budget that matches the actual level of sales.

Theoretically, such alternate budgets can easily be created for a company that produces one product. Simply divide the master budget total variable costs by the master budget total volume to be sold and multiply the result by the revised budgeted total volume to be sold. (Budgeted fixed costs are the same in the flexible budget as they are in the master budget, as long as the changes in volume do not cause the total fixed costs to change.)

In reality, of course, it is impossible to prepare thousands and thousands of flexible budgets, one for every possible activity level and—for a multiple product company—every possible combination of sales. For that reason, the flexible budget is not prepared until the actual level of activity is known.

<sup>34</sup> The term "activity level" is used to refer to the volume of whatever activity is relevant to the situation. The relevant activity levels are usually sales volume and production volume. Thus, "activity level" could refer to either sales volume or production volume.

If a variance is caused by a decline in sales volume below the planned level, of course, the decline in sales does need to be addressed, and a comparison of actual results to the flexible budget will not be useful for recognizing a decline in sales. For that reason, a comparison between actual results and the master budget for sales, variable costs and contribution margin<sup>35</sup> also needs to be done. Thus a flexible budget cannot replace a static budget. Most companies that use flexible budgeting also have their managers report on the variances between the master (static) budget and the flexible budget because those variances are the variances that are due to volume variations.

In determining what variances should be investigated, the following factors should be considered:

- **The magnitude of the variance.** What constitutes a material variance will vary depending on the size of the budget line item. If the budgeted amount is \$1,250, a \$1,000 variance would represent 80% of the budgeted amount and would be important to investigate. But if the budgeted amount is \$1,000,000, a \$1,000 variance would be only 0.10% of the budgeted amount and would not be material.
- **The trend of the variance over time.** If an unfavorable variance has been ongoing for several months and is getting larger, then it needs to be investigated, even if its magnitude is not large.
- **The likelihood that an investigation will eliminate future occurrences of the variance.** This is a cost-benefit determination. If an investigation would not result in any changes that could eliminate future occurrences of the variance, then the benefit to be gained from investigating the variance would not be worth the cost of the investigation.

A flexible budget takes the variable revenues and costs as they are planned in the master budget (the static budget) and adjusts the master budget amounts to what the budgeted amounts would have been if the actual sales volume had been used in preparing the budget.

A flexible budget is prepared and used in addition to the master budget. The flexible budget is different from the master budget because the flexible budget focuses on variances that are caused by things **other than** differences in volume from the volume that was assumed when the master budget was prepared. The flexible budget takes out the portion of the total variance from the master budget that was caused by variances in volume. The flexible budget leaves only the variances that were caused by other factors. Thus the flexible budget allows management to focus on the variances that may be caused by production or administrative problems that need attention.

Note that in a flexible budget **only the variable revenues and costs are adjusted**. Only variable revenues and costs change with changes in volume. Fixed costs are just that: fixed. They do not change with changes in sales volume. Therefore, **fixed costs in the flexible budget are exactly the same as the fixed costs in the static budget**.

**Note:** Flexible budgeting and a standard costing system go together. One is meaningless without the other.

<sup>35</sup> The contribution margin is sales revenue minus variable expenses. A contribution margin per unit can be calculated by subtracting the per-unit variable expenses (i.e., direct materials, direct labor, variable manufacturing overhead and variable selling and variable administrative costs) from the per-unit sales price. The total contribution margin is total sales minus total variable expenses, or the per-unit contribution margin multiplied by the number of units sold.

**Example:** Here is an income statement showing actual results alongside the static budget (the master budget) and the flexible budget prepared for the actual sales volume:

	<b><u>Actual Results</u></b>	<b><u>Static Budget</u></b>	<b><u>Flexible Budget</u></b>
Units sold	20,000	24,000	20,000
Revenues	\$ 2,500,000	\$ 2,880,000	\$ 2,400,000
Variable costs:			
Direct materials	1,243,200	1,440,000	1,200,000
Direct manufacturing labor	396,000	384,000	320,000
Variable manufacturing overhead	<u>261,000</u>	<u>288,000</u>	<u>240,000</u>
Total variable costs	\$ <u>1,900,200</u>	\$ <u>2,112,000</u>	\$ <u>1,760,000</u>
Contribution margin	\$ 599,800	\$ 768,000	\$ 640,000
Fixed costs	<u>570,000</u>	<u>552,000</u>	<u>552,000</u>
Operating income	\$ <u>29,800</u>	\$ <u>216,000</u>	\$ <u>88,000</u>

This flexible budget will now be used along with the static budget for the period's variance reporting. The only difference between the static budget and the flexible budget is the volume used to calculate variable revenues and expenses. The static budget is prepared for a planned sales volume of 24,000 units, whereas the flexible budget is prepared as if the company had a planned sales volume of 20,000 units, which is the actual number of units sold. The variable revenue and cost items in the flexible budget have been adjusted downward for the sales that were lower than planned. Note that the budgeted fixed cost amount is the same in the flexible budget as it is in the static budget.

For each variable revenue and cost, the static budget amount has been divided by the static budget volume of 24,000 to find the budgeted per unit revenue/cost, and that per unit revenue/cost has been multiplied by the actual number of units sold (20,000) to calculate the flexible budget amount. The fixed cost static budget amount of \$552,000 has been carried over to the flexible budget column unchanged.

The flexible budget can be prepared only **after the end of a period**, when the actual volume for the period is known. Therefore, a flexible budget would be prepared for each month or each quarter as well as for the year-end, but only when the actual volume for that period is known.

The primary **advantage** of flexible budgeting is that it enables management to focus its attention on variances caused by factors other than differences between actual and budgeted volumes.

The **limitations** of flexible budgeting include:

- If sales decline below the planned level, the decline does need to be addressed and a flexible budget will not be useful for pinpointing a decline in sales below what was planned.
- Flexible budgeting needs to be used with a standard costing system. The two go together, and one is meaningless without the other.

The section on *Performance Management* covers the use of flexible budgets in variance reporting.



## Other Types of Budgets

### Project Budgeting

As the name suggests, a project budget is a budget for a specific project. As such, the time frame of the budget may be very short or more long-term, depending upon the length of the project.

Project budgets are fundamentally different from the master budget and the flexible budget. The master budget or the flexible budget covers a distinct time span, such as the month of January. In contrast, a project budget covers an identifiable project that has its own time span. That time span may be as little as a week or it may be as long as several years. The focus in project budgeting is on one separate project. Examples of projects that might be budgeted for separately are capital budgeting projects such as the purchase of a new machine or the construction of a new plant. A project may be the development and testing of a new product, the acquisition of another company, a marketing plan for entering a new geographical area, or a budget for a long-term contract.

Projects must be planned over their entire life spans and should be viewed as special commitments. Their budgeted amounts must be integrated into the master budget of the company for the relevant period or periods.

A project budget must include all of the costs that will be required for the project. Though this requirement seems very obvious, indirect costs and overheads that will be allocated to the project can easily be missed. All indirect costs and overheads to be allocated to the project must be identified and included.

A long-term project budget for the introduction of a new product can also be called a **life-cycle budget**. A life-cycle budget plans incomes and expenses for one specific product throughout its entire life cycle, from its development through its decline. This enables a company to see the cash flows that will result from the product over its entire life. When all the lifetime development and production costs are set forth in the life-cycle budget, management can set a price that will cover not only the company's costs but also its required return on investment.

**Benefits** to project budgeting include:

- Management can determine in advance whether or not the project is one that should be undertaken.
- The project budget enables management to plan for the amount of resources (personnel, effort, supervisors, and finances) that will be needed.
- The project budget focuses management's attention on anticipated cash inflows and outflows from the project and the decisions that will affect the cash flows.
- Project budgeting fosters cooperation and coordination among the various responsibility centers that will be affected by the project.
- A project budget covers an identifiable project that has its own time span. That time span may be as short as a week or it may be as long as several years. This gives the project budget more flexibility than other types of budgets.

**Limitations** to project budgeting are:

- Projects must be planned over their entire life spans and thus they should be viewed as special commitments.
- Budgeted amounts for projects must be integrated into the master budget of the company for the relevant period or periods. Unless that is done, the project budget cannot be not fully utilized.

Capital budgeting is covered in depth on the CMA Part 2 exam.

## Activity-Based Budgeting (ABB)

Activity-based budgeting (ABB) is similar in concept to activity-based costing (ABC), which is covered in detail in the section on *Cost Management* (Section D) for this exam. Activity-based costing is an alternate method of allocating overhead costs to products.

Briefly, when activity-based costing is used to allocate overhead costs, the overhead allocations are not based on usage of resources such as direct labor hours or machine hours as in traditional costing.<sup>36</sup> Instead, they are based on **activities performed** and what those activities cost. ABC is much more detailed than traditional costing, because it uses many more cost pools and each cost pool has its own cost driver.

Activity-based budgets are prepared based on the budgeted overhead costs to perform the budgeted activities. Activities that drive the costs are identified and a budgeted level of activity for each of the drivers is determined based on a budgeted level of production. A budgeted cost pool (budgeted overhead costs) is developed for each activity. Budgeted overhead costs per unit of each activity are determined by dividing the total budgeted overhead costs for the activity by the total budgeted units of the activity. Overhead costs are allocated to products on the basis of the budgeted levels of each activity for each product. The company may have several different overhead cost pools, each with a different cost driver and a different cost allocation to the units produced. Thus several different overhead allocations may be made to each product.

In an activity-based budget system, there is a clear relationship between activities performed and output. The advantage of this clear relationship is that when changes are made to products, product design, product mix, manufacturing processes, and so forth, managers are able to examine the effects of the changes on budgeted activities and on the costs of those activities.

If activity-based costing is used as the costing system, then the budget should also be activity-based to enable continuous improvement and also to make comparisons between actual results and budgeted results meaningful. Activity-based budgeting is an extension of the company's activity-based costing system and uses the same activity cost pools to group budgeted costs as the activity-based costing system uses to group actual costs.

However, before using the current year's activity cost pools to develop the next period's budget, a firm needs to review its activity pools and the costs going into each for their continued appropriateness and accuracy. Some of the factors may change before the future budget period begins, and data from the current ABC system may need to be updated. Updating of the current ABC system will be needed especially if variances during the current or previous periods have been significant. For example, new equipment may have been acquired that has decreased setup time per batch and/or supervisory time during setup or production. Cost per setup will change as a result.

**Benefits** of activity-based budgeting include:

- The process of preparing an activity-based budget brings out information about opportunities for cost reductions and the elimination of wasteful activities. Thus, activity-based budgeting makes it possible to identify and enhance high value-added activities and to eliminate low value-added activities. This promotes continuous improvement.
- It helps managers to identify resources needed and changes that will be needed in resources if changes are made in products offered, product design, product mix, manufacturing processes, and so forth.
- Budgeted costs are based on the costs for the resources required to perform the budgeted activities. This defines a clear relationship between resource consumption, costs, and output.
- It helps to identify budgetary slack.

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<sup>36</sup> The traditional method of applying overhead costs to units produced uses either machine hours or direct labor hours allowed per unit of output as the basis of the allocation. The budgeted total overhead fixed costs are determined and the budgeted total overhead variable costs are determined. The budgeted overhead costs are divided by the number of hours (machine or labor) budgeted to find the fixed and variable costs per hour allowed for the budgeted output, and the result is the standard overhead cost per hour. The standard overhead cost per hour multiplied by the number of hours (direct labor or machine) allowed per unit is the standard overhead cost per unit.

**Limitations** of activity-based budgeting include:

- It must be used in conjunction with activity-based costing. Activity-based budgeting is an extension of the company's activity-based costing system, and it uses the same activity cost pools for grouping costs as the activity-based costing system. In addition, activity-based budgeting and activity-based costing must be used together to make comparisons between actual results and budgeted results.
- Both ABC and ABB require more work than a traditional costing and budgeting system<sup>37</sup> and so are more costly to implement. Costs include the research needed to do the cost allocations and the time required to educate managers about the cost allocations. The more complex the cost allocations are, the higher the costs to educate.

The example on the next two pages compares budgeted overhead cost allocations developed using the traditional allocation method with allocations developed using activity-based budgeting.

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<sup>37</sup> A traditional costing system is one in which overhead costs are allocated to products on the basis of one single cost driver (such as machine hours or direct labor hours allowed for the actual output) and one single cost pool (such as all overhead costs). In contrast, when an activity-based system is used, a company may have several cost pools for different types of overhead costs and each cost pool will have its own cost driver. The costs are broken down much more finely.

**Example:** Here is a comparison between cost allocations developed using first the traditional method and then using activity-based budgeting. Facts from the previous examples for Wood Creations are used.

### Traditional Overhead Allocation

Total budgeted overhead costs:

Fixed costs for capacity of 11,080 direct labor hours:

Depreciation	\$ 2,240	
Supervisory salaries and employee costs	30,000	
Other indirect fixed costs	<u>1,000</u>	\$33,240

Variable costs:

Indirect manufacturing labor	\$13,960	
Equipment maintenance	5,000	
Supplies	<u>3,200</u>	<u>22,160</u>

**Total budgeted manufacturing overhead costs** **\$55,400**

Standard overhead cost per direct labor hour based on 11,080 direct labor hours budgeted:  
 $\$55,400 \div 11,080 = \underline{\$5.00}$  per direct labor hour

The direct labor hours allowed for each of the three products produced by Wood Creations are as follows:

Birdhouses	0.6 DLH per unit
Benches	2.0 DLH per unit
Bowls	1.0 DLH per unit

The standard overhead rate using traditional overhead allocation based on direct labor hours allowed per unit results in the following overhead costs per unit for each of the three products:

Birdhouses: 0.6 DLH × \$5 = \$3.00 per unit
Benches: 2.0 DLH × \$5 = \$10.00 per unit
Bowls: 1.0 DLH × \$5 = \$5.00 per unit

Wood Creations has decided to separate its operations into a Fabricating Department and a Finishing Department. Management wants to use activity-based costing and activity-based budgeting to allocate the overhead separately in each department. The overhead costs in the Fabricating Department will be allocated on the basis of number of setups, whereas the overhead costs in the Finishing Department will be allocated on the basis of direct labor hours used in the Finishing department. (The number of direct labor hours used in Finishing is lower than the total number of direct labor hours used in both departments.)

Budgeted overhead costs have been divided between the two departments as follows:

	<b><u>Fabricating</u></b>	<b><u>Finishing</u></b>	<b><u>Total</u></b>
Fixed costs:			
Depreciation	\$ 1,800	\$ 440	\$ 2,240
Supervisory salaries and employee costs	12,000	18,000	30,000
Other indirect fixed costs	700	300	1,000
Variable costs:			
Indirect manufacturing labor	4,100	9,860	13,960
Equipment maintenance	4,500	500	5,000
Supplies	<u>1,000</u>	<u>2,200</u>	<u>3,200</u>
<b>Total budgeted manufacturing overhead costs</b>	<b>\$24,100</b>	<b>\$31,300</b>	<b>\$55,400</b>

(Continued)

<u>Activity Bases</u>	<u>Birdhouses</u>	<u>Benches</u>	<u>Bowls</u>	<u>Total</u>
No. of setups in Fabricating	30	20	10	60
No. of DLH per unit in Finishing	0.4	1.5	0.2	
	<u>Birdhouses</u>	<u>Benches</u>	<u>Bowls</u>	<u>Total</u>
Total units to be produced (from Production Budget)	4,050	2,550	3,550	10,150

### Activity-Based Budgeting: Fabricating Department

**Budgeted fabricating overhead cost per setup:**  $\$24,100 \div 60 = \$401.67$  per setup

**Budgeted fabricating overhead cost allocated to products on the basis of setups:**

Birdhouses: $\$401.67 \times 30$	\$12,050
Benches: $\$401.67 \times 20$	8,033
Bowls: $\$401.67 \times 10$	<u>4,017</u>
Total fabricating OH cost	\$24,100

**Budgeted fabricating overhead cost per unit budgeted:**

Birdhouses:  $\$12,050 \div 4,050$  units budgeted = \$2.98

Benches:  $\$8,033 \div 2,550$  units budgeted = \$3.15

Bowls:  $\$4,017 \div 3,550$  units budgeted = \$1.13

### Activity-Based Budgeting: Finishing Department

**Total budgeted Direct Labor Hours Used in Finishing:**

Birdhouses: 0.4 hours $\times$ 4,050	1,620
Benches: 1.5 hours $\times$ 2,550	3,825
Bowls: 0.2 hours $\times$ 3,550	<u>710</u>
Total direct labor hours	6,155

**Budgeted finishing overhead cost per DLH:**  $\$31,300 \div 6,155 = \$5.0853$  per DLH

**Budgeted finishing overhead cost allocated to products on the basis of DLH allowed:**

Birdhouses: $\$5.0853$ per DLH $\times$ 0.4 DLH per unit $\times$ 4,050 units =	\$ 8,238
Benches: $\$5.0853$ per DLH $\times$ 1.5 DLH per unit $\times$ 2,550 units =	19,451
Bowls: $\$5.0853$ per DLH $\times$ 0.2 DLH per unit $\times$ 3,550 units =	<u>3,611</u>
Total finishing overhead cost	\$31,300

**Budgeted finishing overhead cost per budgeted unit:**

Birdhouses:  $\$8,238 \div 4,050$  units budgeted = \$2.03 per unit

Benches:  $\$19,451 \div 2,550$  units budgeted = \$7.63

Bowls:  $\$3,611 \div 3,550$  units budgeted = \$1.02

**Standard overhead allocated per unit using Activity-Based Budgeting:**

	<u>Fabricating</u>	<u>Finishing</u>	<u>Total</u>
Birdhouses	\$2.98	\$2.03	\$ 5.01
Benches	3.15	7.63	10.78
Bowls	1.13	1.02	2.15

The standard overhead allocated to each unit when calculated using the traditional method was \$3.00 for birdhouses, \$10.00 for benches, and \$5.00 for bowls. Using activity-based budgeting, The standard overhead allocated to each unit is \$5.01 for birdhouses, \$10.78 for benches, and \$2.15 for bowls. Using ABB, birdhouses and benches will receive higher allocations of overhead than under the traditional method, while bowls will receive a lower allocation of overhead than they would under the traditional method.

## Zero-Based Budgeting

Typically, budgets are developed by starting with the current period's actual or current period's budgeted figures and adjusting them for any changes anticipated in the coming period. This process assumes that the budget period will be related to the current period. The focus is on things that are expected to change during the coming year. This is called an **incremental** approach to budgeting.

Zero-based budgeting is different. Under zero-based budgeting, the budget is prepared **without any reference to, or use of, the current period's budget or the likely operating results for the current period**. Every planned activity must be justified with a cost-benefit analysis.

Though zero-based budgeting is more time consuming and difficult than an incremental approach to budgeting, it does have **advantages**.

- In zero-based budgeting, all of the activities that a department undertakes are identified and then justified. Only revenues and costs from activities that are justified are included in the budget. Because the budget is built up from zero, each manager must justify all of the expenses in his or her department. This is preferable to the incremental approach because it enables the company to identify expenses that are not value-adding or that should be reduced due to some development in production methods or something similar.
- Having to justify every activity forces a prioritizing of activities because the activities are ranked on the basis of their cost-benefit analyses in order to determine which ones are justified. This ranking provides a systematic basis for resource allocation.
- Because a manager needs to examine every single expenditure and activity within the department, he or she is more likely to develop better and/or less costly methods of accomplishing the same objectives. This development of alternative methods is the chief benefit of zero-based budgeting.

**Note:** With incremental budgeting, we assume that the actual results from the current period are acceptable for future periods. With zero-based budgeting, we do not make that assumption.

The disadvantage and major **limitation** of zero-based budgeting is that it can require a nearly impossible amount of work to review **all** of a company's activities every year. As an alternative, a company could schedule zero-based budgeting on a rotating basis, with only a few different departments or divisions being subject to an in-depth review of their activities each year.

## Continuous (Rolling) Budgets

A **continuous budget**, also called a **rolling budget**, is one that is prepared for a certain period of time ahead of the present. For example, a one-year continuous budget would be prepared at the end of every month for the next twelve months.

Continuous budgets are discussed in more detail in *Time Frames for Budgets* in the Budgeting Concepts section of this textbook.

Question 70: The type of budget that is available on a continuous basis for a specified future period by adding a month, quarter or year in the future as the present month, quarter or year ends is called a

- a) Rolling budget.
- b) Kaizen budget.
- c) Activity-based budget.
- d) Flexible budget.

(ICMA 2010)

Question 71: Which one of the following is **not** an advantage of activity-based budgeting?

- a) Better identification of resource needs
- b) Linking of costs to outputs
- c) Identification of budgetary slack
- d) Reduction of planning uncertainty

(ICMA 2010)

Question 72: The major feature of zero-based budgeting is that it:

- a) Takes the previous year's budget and adjusts for inflation.
- b) Questions each activity and determines whether it should be maintained as is, reduced or eliminated.
- c) Assumes all activities worthy of receiving budget increases to cover increased costs.
- d) Focuses on planned capital outlays for property, plant and equipment.

(CIA Adapted)

## Ongoing Budget Reports

After the budgets are determined and approved, they will be used throughout the year to measure how the actual results compare to the budgeted results. We have referred to the importance of variance reporting throughout this section, but it bears repeating.

A budget variance report does this measurement by comparing the actual item (revenues, expenses, or units) with the budgeted amount for the same time period. If the company is ahead of the budget (meaning that revenues are higher than budgeted or expenses are lower than budgeted), the company has a **favorable variance**. If the opposite is true, the company has an **unfavorable variance**. Variance analysis is covered in detail in the Performance Management section of this textbook.

If the variances are significant or unexpected, the company must investigate and determine the cause of the variance. Some variances are expected. For instance, if sales are higher than budgeted, then it is only logical that there will be appear to be an unfavorable variance in direct materials and direct labor if the company uses a fixed (or static) budget for the variance reporting. However, this is a matter for concern only if the flexible budget variances for direct materials and direct labor are also unfavorable. If the variances are caused only by the higher than expected sales having resulted in increased cost of sales, the variances are not a cause for concern.

Investigating the causes of **unexpected variances** is one of the most important steps in the budgeting process. This analysis is part of the **control loop**, which is the process by which the activities of the company are controlled.

The major steps in the control loop are:

- 1) **Establish** the budget or standards of performance.
- 2) **Measure** the actual performance.
- 3) **Analyze and compare** actual results with the budgeted results (this is the budget report).
- 4) **Investigate** unexpected variances.
- 5) **Devise and implement** any necessary corrective actions.
- 6) **Review and revise** the budget or standards if necessary.

## Answering Budgeting Exam Questions

In this section of the Exams, one of the most critical things you will need to do is make budgeting calculations. Though at first these questions are very intimidating, they will become easier as you do more of them. There are four main types of numbers questions. Once you become familiar with them, they will become easier.

- 1) One set of calculations that you will need to make addresses this question: **"What would the flexible budget have been?"** You will be given a set of circumstances and the question will be related to what the flexible budget would have given as the budgeted amount. This calculation is made by multiplying the standard rate by the actual quantity produced, sold, or whatever is required given the situation.
- 2) There are also a number of questions where you will need to **calculate the number of units that a company needs to produce or purchase within a given time period** (usually a month) in order to meet the demand for that period and the opening beginning inventory required for the next month. These questions are based on the following formula:

$$\begin{aligned}
 & \text{Units needed for use in the current period} \\
 + & \text{Units needed for the next month's beginning inventory (ending inventory)} \\
 = & \text{Total Units needed this period} \\
 - & \text{Units on hand at the start of this period (beginning inventory)} \\
 = & \text{Units needed to be produced or purchased this period}
 \end{aligned}$$

With this formula we are looking at the inventory question in two parts. The first part is to determine how many units will be needed during the period. Units will be needed either for production or for ending inventory. This is the line "Total units needed this period." There are two sources of these units of inventory. Either the company will have them in beginning inventory at the start of the period or they will need to purchase or produce the units. The second part of the process calculates how many units will need to be produced or purchased during the period.

**Note:** This formula is essentially the same as the formula we used to calculate how many units the company needed to produce when we were calculating the production budget.

- 3) Another type of question may relate to the **amount of cash collected or spent during a period** (usually a month). Though these questions are difficult to read, the actual math is not that difficult. The key is to make sure you identify how much of the credit sales are collected in the month of the sale and how much are collected after the month of the sale. The same is true for payables: you need to identify when the cash is actually paid.
- 4) The last type of question requires the use of the basic inventory formula. The formula may be restated for use in different circumstances, depending upon which one of the items in the formula is unknown. But if you can remember this one commonsense, basic inventory formula, you will be able to restate it as needed. If you prefer, you can use it like this without restating it and simply solve for the unknown. The formula is:

$$\text{Beginning Inventory} + \text{Inventory Added} - \text{Inventory Removed} = \text{Ending Inventory}$$

If you have any three of the four amounts, you can calculate the fourth amount algebraically. Note that sometimes a problem will not specifically give you all of the three known amounts you need in order to find the fourth amount. However, it will always give the information you need to calculate the three known amounts.

- **When applied to Finished Goods Inventory costs**, the formula is as follows:

$$\text{Cost of Beginning Inventory} + \text{Net Cost of Purchases (for a reseller) or Cost of Goods Manufactured (for a manufacturer)} - \text{Cost of Goods Sold} = \text{Cost of Ending Inventory}$$



- **For Finished Goods Inventory in units**, the formula is as follows:

Units in Beginning Inventory + Net Units Purchased or Manufactured – Units Sold = Units in Ending Inventory

- **When applied to Direct Materials Inventory costs**, the formula is as follows:

Cost of Beginning Inventory + Net Cost of Purchases – Cost of Materials Used in Production = Cost of Ending Inventory

- **For Direct Materials Inventory in units**, the formula is as follows:

Units in Beginning Inventory + Net Units Purchased – Units Used in Production = Units in Ending Inventory

Net Cost of Purchases means purchases minus returns plus landing costs (shipping-in costs). If those costs are given in a problem, they should be used if it is necessary to calculate the net cost of purchases. If units purchased and units returned are given, those should be used if it is necessary to calculate Net Units Purchased.

### Flexible Budgeting Questions

Question 73: RedRock East Company uses flexible budgeting for cost control. RedRock produced 10,800 units of product during March, incurring an indirect materials cost of \$13,000. Its master budget for the year reflected an indirect materials cost of \$180,000 at a production volume of 144,000 units. A flexible budget for March should reflect indirect material costs of:

- a) \$13,975
- b) \$13,500
- c) \$13,000
- d) \$11,700

(CMA Adapted)

Question 74: Butteco has the following costs for 100,000 units of product:

Raw materials	\$200,000
Direct labor	100,000
Manufacturing overhead	200,000
Selling/administrative expense	150,000

All costs are variable except for \$100,000 of manufacturing overhead and \$100,000 of selling/administrative expenses. The total costs to produce and sell 110,000 units are:

- a) \$650,000
- b) \$715,000
- c) \$695,000
- d) \$540,000

(CMA Adapted)

Question 75: Based on past experience, a company has developed the following budget formula for estimating its shipping expenses. The company's shipments average 12 lbs. per shipment:

$$\text{Shipping costs} = \$16,000 + (\$0.50 \times \text{lbs. shipped})$$

The planned activity and actual activity regarding orders and shipments for the current month are given in the following schedule:

	<u>Plan</u>	<u>Actual</u>
Sales orders	800	780
Shipments	800	820
Units shipped	8,000	9,000
Sales	\$120,000	\$144,000
Total pounds shipped	9,600	12,300

The actual shipping costs for the month amounted to \$21,000. The appropriate monthly flexible budget allowance for shipping costs for the purpose of performance evaluation would be:

- a) \$20,680
- b) \$20,800
- c) \$22,150
- d) \$20,920

(CMA Adapted)

Question 76: Barnes Corporation expected to sell 150,000 board games during the month of November, and the company's master budget contained the following data related to the sale and production of these games:

Revenue	\$2,400,000
Cost of goods sold	
Direct materials	675,000
Direct labor	300,000
Variable factory overhead	<u>450,000</u>
Contribution	\$ 975,000
Fixed overhead	250,000
Fixed selling/administration	<u>500,000</u>
Operating income	<u>\$ 225,000</u>

Actual sales during November were 180,000 games. Using a flexible budget, the company expects the operating income for the month of November to be:

- a) \$225,000
- b) \$420,000
- c) \$510,000
- d) \$270,000

(CMA Adapted)

**Units to Produce / Purchase Questions**

Question 77: The Jung Corporation's budget calls for the following production, in number of units:

Qtr. 1 – 45,000 units      Qtr. 2 – 38,000 units      Qtr. 3 – 34,000 units      Qtr. 4 – 48,000 units

Each unit of product requires 3 pounds of direct material. The company's policy is to begin each quarter with an inventory of direct materials equal to 30% of that quarter's direct material requirements. Budgeted direct materials purchases for the third quarter are:

- a) 38,200 pounds.
- b) 89,400 pounds.
- c) 114,600 pounds.
- d) 29,800 pounds.

(CMA Adapted)

**The following information is for the next two questions:** Berol Company, which plans to sell 200,000 units of finished product in July, anticipates a growth rate in sales of 5% per month. The desired monthly ending inventory in units of finished product is 80% of the next month's estimated sales. There are 150,000 finished units in inventory on June 30.

Each unit of finished product requires 4 pounds of direct materials at a cost of \$1.20 per pound. There are 800,000 pounds of direct materials in inventory on June 30.

Question 78: Berol Company's production requirement in units of finished product for the 3-month period ending September 30 is:

- a) 712,025 units.
- b) 638,000 units.
- c) 665,720 units.
- d) 630,500 units.

Question 79: Assume Berol Company plans to produce 600,000 units of finished product in the 3-month period ending September 30, and to have direct materials inventory on hand at the end of the 3-month period equal to 25% of the use in that period. The estimated cost of direct materials purchases for the 3-month period ending September 30 is:

- a) \$2,200,000
- b) \$2,880,000
- c) \$2,640,000
- d) \$2,400,000

(CMA Adapted)

**The following information is for the next two questions:** Daffy Tunes manufactures a toy rabbit with moving parts and a built-in voice box. Projected sales in units for the next 5 months are as follows:

<u>Month</u>	<u>Projected Sales in Units</u>
January	30,000
February	36,000
March	33,000
April	40,000
May	29,000

Each rabbit requires basic materials that Daffy purchases from a single supplier at \$3.50 per rabbit. Voice boxes are purchased from another supplier at \$1.00 each. Assembly labor cost is \$2.00 per rabbit, and variable overhead cost is \$0.50 per rabbit. Fixed manufacturing overhead applicable to rabbit production is \$12,000 per month. Daffy's policy is to manufacture 1.5 times the coming month's projected sales every other month, starting with January (i.e., odd-numbered months) for February sales, and to manufacture 0.5 times the coming month's projected sales in alternate months (i.e., even-numbered months). This allows Daffy to allocate limited manufacturing resources to other products as needed during the even-numbered months.

Question 80: The unit production budget for toy rabbits for January is:

- a) 45,000 units.
- b) 54,000 units.
- c) 16,500 units.
- d) 14,500 units.

Question 81: The dollar production budget for toy rabbits for February is:

- a) \$327,000
- b) \$127,500
- c) \$113,500
- d) \$390,000

(CMA Adapted)

**The following information is for the next three questions:** Rokat Corporation is a manufacturer of tables sold to schools, restaurants, hotels and other institutions. Rokat manufactures the table tops, but an outside supplier sells the table legs to Rokat. The Assembly Department takes a manufactured table top and attaches the 4 purchased table legs. It takes 20 minutes of labor to assemble a table. The company follows a policy of producing enough tables to ensure that 40% of next month's sales are in the finished goods inventory. Rokat also purchases sufficient raw materials to ensure that raw materials inventory is 60% of the following month's scheduled production. Rokat's sales budget in units for the next quarter is as follows:

July	2,300
August	2,500
September	2,100

Rokat's ending inventories in units for June 30 are:

Finished goods	1,900
Raw materials (legs)	4,000

Question 82: The number of tables to be produced during August is:

- a) 1,900 tables.
- b) 1,440 tables.
- c) 2,340 tables.
- d) 1,400 tables.

Question 83: Assume the required production for August and September is 1,600 and 1,800 units respectively, and the number of table legs in the July 31 raw materials inventory is 4,200 units. The number of table legs to be purchased in August is:

- a) 2,200 legs
- b) 6,520 legs.
- c) 6,400 legs.
- d) 9,400 legs.

Question 84: Assume that Rokat Corporation will produce 1,800 units in the month of September. How many employees will be required for the Assembly Department? (Fractional employees are acceptable since employees can be hired on a part-time basis. Assume a 40-hour week and a 4-week month.)

- a) 3.75 employees.
- b) 60 employees.
- c) 15 employees.
- d) 600 employees.

(CMA Adapted)

**The following information is for the next two questions:** Wellfleet Company manufactures recreational equipment and prepares annual operational budgets for each department. The Purchasing Department is finalizing plans for the fiscal year ending June 30, 20X9, and has gathered the following information regarding 2 of the components used in both tricycles and bicycles. Wellfleet uses the first-in, first-out inventory method.

	<u>A19</u>	<u>B12</u>	<u>Tricycles</u>	<u>Bicycles</u>
Beginning inventory, July 1, 20X8	3,500	1,200	800	2,150
Ending inventory, June 30, 20X9	2,000	1,800	1,000	900
Unit cost	\$1.20	\$4.50	\$54.50	\$89.60
Projected fiscal year unit sales	--	--	96,000	130,000
Component usage:				
Tricycles	2/unit	1/unit	--	--
Bicycles	2/unit	4/unit	--	--

Question 85: The budgeted dollar value of Wellfleet Company's purchases of component A19 for the fiscal year ending June 30, 20X9 is:

- a) \$309,000
- b) \$540,600
- c) \$2,017,800
- d) \$538,080

Question 86: If the economic order quantity of component B12 is 70,000 units, the number of times that Wellfleet Company should purchase this component during the fiscal year ended June 30, 20X9 is:

- a) Eight times.
- b) Nine times.
- c) Four times.
- d) Five times.

(CMA Adapted)

## Cash Flow Questions

Question 87: DeBerg Co. has developed the following sales projections for the year:

May	\$100,000	August	\$160,000
June	\$120,000	September	\$150,000
July	\$140,000	October	\$130,000

Normal cash collection experience has been that 50% of sales are collected during the month of sale and 45% are collected the following month. The remaining 5% of sales is never collected. DeBerg's budgeted cash collections for the third calendar quarter are:

- a) \$450,000
- b) \$440,000
- c) \$414,000
- d) \$360,000

(CMA Adapted)

**The following information is for the next two questions:** Information about Noskey Corporation's sales revenue is presented in the following table.

	November (Actual)	December (Budget)	January (Budget)
Cash sales	\$ 80,000	\$100,000	\$ 60,000
Credit sales	<u>240,000</u>	<u>360,000</u>	<u>180,000</u>
Total sales	\$320,000	\$460,000	\$240,000

Management estimates that 5% of credit sales are uncollectible. Of the credit sales that are collectible, 60% are collected in the month of sale and the remainder in the month following the sale. Purchases of inventory are equal to next month's sales and gross profit margin is 30%. All purchases of inventory are on account; 25% are paid during the month of purchase, and the remaining 75% are paid during the month following the purchase.

Question 88: Noskey Corporation's budgeted cash collections in December from November credit sales are:

- a) \$136,800
- b) \$91,200
- c) \$144,000
- d) \$96,000

Question 89: Noskey Corporation's budgeted total cash receipts in January are:

- a) \$294,000
- b) \$239,400
- c) \$299,400
- d) \$240,000

(CMA Adapted)

**The following information is for the next two questions:** The Raymar Company is preparing its cash budget for the months of April and May. The firm has established a \$200,000 line of credit with its bank at a 12% annual rate of interest on which borrowings for cash deficits must be made in \$10,000 increments. There is no outstanding balance on the line of credit loan on April 1. Principal repayments are to be made in any month in which there is a surplus of cash. Interest is to be paid monthly. If there are no outstanding balances on the loans, Raymar will invest any cash in excess of its desired end-of-month cash balance in U.S. Treasury bills. Raymar intends to maintain a minimum balance of \$100,000 at the end of each month by either borrowing for deficits below the minimum balance or investing any excess cash. Monthly collection and disbursement patterns are expected to be:

- Collections: 50% of the current month's sales budget and 50% of the previous month's sales budget.
- Accounts Payable Disbursements: 75% of the current month's accounts payable budget and 25% of the previous month's accounts payable budget.
- All other disbursements occur in the month in which they are budgeted.

	<u>Budget Information</u>		
	<u>March</u>	<u>April</u>	<u>May</u>
Sales	\$40,000	\$50,000	\$100,000
Accounts payable	30,000	40,000	40,000
Payroll	60,000	70,000	50,000
Other disbursements	25,000	30,000	10,000

Question 90: In April, Raymar's budget will result in:

- \$45,000 in excess cash.
- A need to borrow \$50,000 on its line of credit for the cash deficit.
- A need to borrow \$100,000 on its line of credit for the cash deficit.
- A need to borrow \$92,500 on its line of credit for the cash deficit.

Question 91: In May, Raymar will be required to:

- Borrow an additional \$30,000 principal and pay \$1,000 interest.
- Repay \$90,000 principal and pay \$100 interest.
- Pay \$900 interest.
- Borrow an additional \$20,000 and pay \$1,000 interest.

(CMA Adapted)



## Forecasting Techniques

### Forecasting and Budgeting

One of the most important parts of the planning and budgeting process is the identification of the assumptions that a company must make about the future. Since planning and budgeting involve looking into the future, the company must make some assumptions about the outlook for the environment in which its business operates. These assumptions are called **premises**. When identifying premises, it is essential that management focus only on those that will actually impact the potential success of the business. Focusing on premises that are not a critical part of the organization's success wastes valuable time and resources.

Some premises will affect the whole company, whereas some premises will not. Different departments will have different premises because of the unique tasks and circumstances they face. The finance department may be concerned about the expected interest rate, but the interest rate will not impact the production department in the fulfillment of its objectives. However, the rate of growth (or rate of contraction) in the economy and the rate of inflation (or deflation) expected during the budget period will probably impact planning and budgeting for nearly every area of the organization.

This section covers forecasting techniques that can be used to develop budgeted amounts that are based on premises. Once the premises have been identified and quantified, the forecasting can be done.

**Mathematical models** are commonly used in forecasting. A mathematical model is an equation that attempts to represent an actual situation. For example, if a company has a product that it sells for \$1,000 each, and if we use  $R$  to represent total revenue, the total revenue that the company will earn by selling  $x$  units can be represented by the following equation or mathematical model:

$$R = 1,000x$$

For a model to be useful, it must be a good representation of the real situation. Therefore, it is important to carefully construct the equations that are used in forecasting.

### Collecting the Data for a Forecast

In forecasting, historical data is used in various ways. We may look at the past to discover a pattern for use in predicting the future or we may look at the past relationship between two factors to determine if there has been a cause-and-effect relationship that can be used to predict future results. Collecting the data is usually the most difficult step in analysis. One of the primary challenges in forecasting costs is finding the **cost driver** that best fits the data—in other words, the **causal factor** in the cause-and-effect relationship.

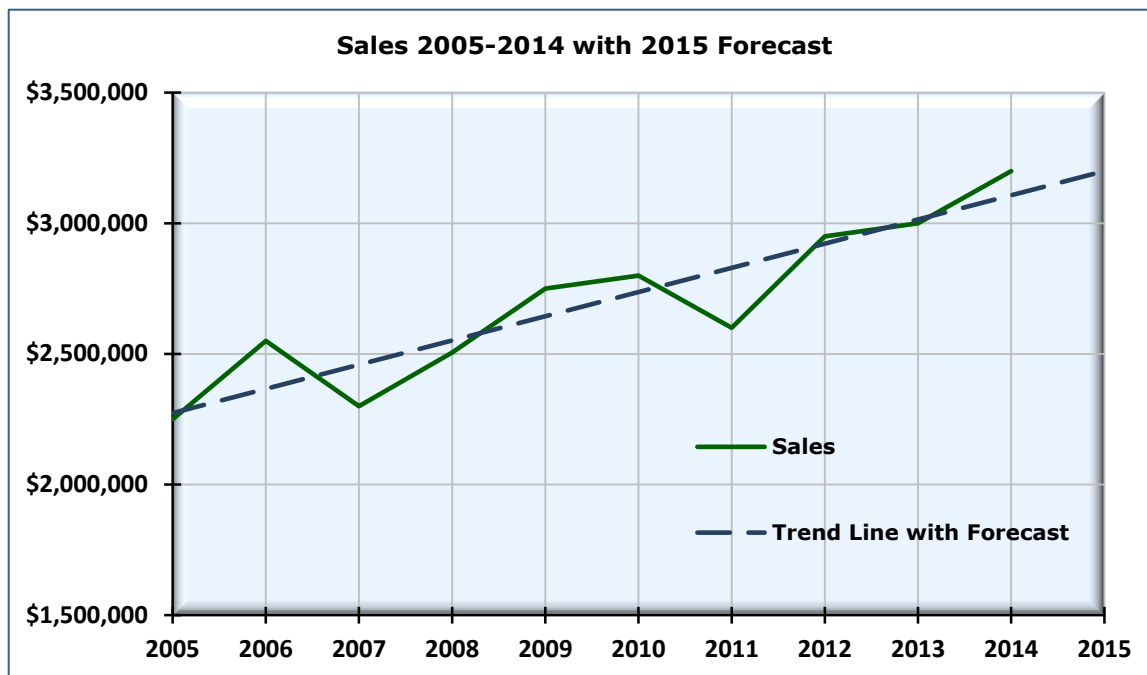
Thus, there are **two basic forecasting methods**:

- 1) **Time series methods**, which look only at the historical pattern of one variable and generate a forecast by extrapolating the pattern using one or more of the **components** (or **patterns**) of the time series, and
- 2) **Causal forecasting methods**, which look for a cause-and-effect relationship between the variable we are trying to forecast (the **dependent variable**) and one or more other variables (the **independent variables**).

### Time Series Analysis

Time series data reflects historical activity for **one variable** over a sequence of past time periods. The variable may be sales revenue for a segment of the organization, production volume for a plant, expenses in one expense classification, or anything being forecasted. A time series method of forecasting **uses only these historical values** in an attempt to find a pattern that can be used in forecasting the future. Only one set of historical time series data is used in time series analysis and this historical data is not compared to any other set of data.

Time series analysis looks at patterns of the desired variable over time. The most frequent pattern and the one most amenable to using for forecasting is a **trend** pattern, in which the historical data exhibits a gradual shifting to a higher or lower level. If a long-term trend exists, short-term fluctuations may take place within that trend; however, the long-term trend will be apparent. For example, sales from year to year may fluctuate but overall they may be trending upward, as is the case in the graph below.



The long-term sales trend has been upward from 2005 to 2014 despite the dips in 2007 and 2011. According to this trend, a reasonable sales forecast for 2015 would be \$3,200,000.

Trends in a time series analysis are not always upward and linear like the above graph. Time series data can exhibit an upward linear trend, a downward linear trend, a nonlinear (curved) trend, or no trend at all. A scattering of points that have no relationship to one another would represent no trend at all.

A trend pattern is analyzed for forecasting purposes using **simple regression analysis**.

### Trend Projection and Regression Analysis

A time series that has a long-term upward or downward trend can be forecasted by means of **trend projection**. A trend projection is done with **simple regression analysis**<sup>38</sup>, which forecasts values using historical information from all available past observations of the value.

Simple linear regression analysis relies on two assumptions:

- Variations in the dependent variable (i.e., what we are forecasting) are **explained by variations in one single independent variable** (i.e., the passage of time, if a time series is what we are forecasting).
- The relationship between the independent variable (time or a specific value) and the dependent variable (sales or whatever we are forecasting based on the value of the independent variable) is

<sup>38</sup> **Simple regression analysis** is called "simple" to differentiate it from multiple regression analysis. The difference between **simple** linear regression and **multiple** linear regression is in the number of independent variables. A **simple** linear regression has only one independent variable. In a time series, that independent variable is the passage of time. A **multiple** linear regression has more than one independent variable. Multiple linear regression analysis is covered later in this section of the text.

**linear.** A linear relationship is one in which the relationship between the independent variable and the dependent variable can be approximated by a straight line on a graph. The regression equation, which approximates the relationship, will graph as a straight line.

The equation of a linear regression line is:

$$\hat{y} = ax + b$$

Where:

- $\hat{y}$  = the **predicted** value of  $y$  on the regression line corresponding to each value of  $x$
- $a$  = the slope of the line
- $b$  = the  $y$ -intercept, or the value of  $y$  when  $x$  is zero (0)
- $x$  = the value of  $x$  on the  $x$ -axis that corresponds to the value of  $y$  on the regression line

This equation will be discussed and explained in more detail later. It is included here to explain why the relationship between the independent and the dependent variables graphs as a straight line. None of the variables in the equation are squared or cubed or have any other exponents, thus creating the straight line when the equation is graphed. If an equation contains any exponents, the graphed result will be a curved line.

The line of best fit, as determined by **simple linear regression**, is a formalization of the way we would fit a line through the graphed data just by looking at it. To fit a line by looking at it, we would use a ruler and move it up and down until we think we have **minimized the differences** between the points and the line drawn with the ruler. This will usually be a straight line located at the position where approximately the same number of points are above the line as are below it and the distance between each point and the line is as small as possible.

Linear regression is used to calculate the location of the regression line mathematically. On a graph, the difference between each point and its corresponding point on the regression line is called a **deviation**. When the position of the regression line is calculated mathematically, the line will be in the position where the deviations between each graphed value and the regression line have been minimized. The resulting regression line is the "line of best fit." That line can then be used for forecasting by means of extrapolation that extends the line into the future period or periods.

Simple linear regression was used to calculate the regression lines and the forecasts on the two graphs presented earlier as examples of a **trend pattern** and a **cyclical pattern** (that is, examples 1a and 1b from Forecasting Techniques). The graphs were created in Microsoft Word, and Word calculated the location of the regression line and extended it out for one additional year to create a forecast for that year.

The first step in using regression analysis to forecast a value is to determine whether it even can be used. Make a rough graph of the historical values in the time series and review the results. If the long-term trend appears to be linear, **simple linear regression analysis** can be used to determine the location of the linear regression line.

The regression line is called a **trend line** when the regression is being done on a time series. When the regression is being done on data other than a time series, as is done in causal forecasting (which will be discussed next), the regression line is simply called a regression line. However, the regression line is calculated the same way in both types of data.

**Note:** The  $x$ -axis on the graph is always the horizontal axis and the  $y$ -axis is always the vertical axis. The  $x$ -axis represents the independent variable and the  $y$ -axis represents the dependent variable. In a time series regression analysis, the passage of time is the independent variable and is on the  $x$ -axis.

Before relying on regression analysis to develop a forecast, however, **correlation analysis** should be performed. Correlation analysis determines the **strength of the linear relationship between the  $x$  values and their related  $y$  values**. The results of the correlation analysis tell the forecaster whether the

relationship between the dependent variable (sales, for example) and the independent variable (the passage of time, for a time series) is reasonable.

**Note: Correlation** describes the degree of the relationship between two variables. If high measurements of one variable tend to be associated with high measurements of the other variable, or low measurements of one variable tend to be associated with low measurements of the other variable, we say that the two variables are **positively correlated**. If high measurements of one variable tend to be associated with low measurements of the other variable, we say that the two variables are **negatively correlated**. If there is a close match in the movements of the two variables over a period of time, either positive or negative, we say the **degree of correlation is high**.

However, **correlation alone does not prove causation**. In a time series, the only independent variable is the passage of time. Many factors in addition to time can affect the level of sales. Economic cycles, promotional programs undertaken, and industry-wide conditions such as new government regulations can cause changes in sales volume, to name a few examples. If regression analysis is used to develop a forecast, the forecast should be adjusted for other known factors that may have affected the historical data and that may affect the forecast.

### The Coefficient of Correlation ( $r$ )

The **coefficient of correlation** measures the relationship between two variables. The coefficient of correlation is a number that expresses how closely connected, or correlated, the two variables are and the extent to which a change in one variable has historically resulted in a change in the other.

The **coefficient of correlation**, represented by  $r$  (or  $R$ ), is a numerical measure that expresses both the **direction** (positive or negative) and the **strength** of the linear association between the two variables. In linear regression analysis using only one variable (such as sales), the period of time serves as the independent variable (x-axis) while the sales level serves as the dependent variable (y-axis).

When a time series (such as sales over a period of several years) is graphed, the data points on the graph may show an upsloping linear pattern, a downsloping linear pattern, a nonlinear pattern (such as a curve), or no pattern at all. The pattern of the data points indicates the amount of **correlation** between the values on the x-axis (time) and the values on the y-axis (sales). This amount of correlation, or **coefficient of correlation ( $r$ )**, is expressed as a number between  $-1$  and  $+1$ .

- A correlation coefficient,  $r$ , of **+1** means there is a perfect **positive** (upsloping) linear relationship between each value for  $x$  and its corresponding value for  $y$ . When  $x$  increases,  $y$  increases by the same proportion; when  $x$  decreases,  $y$  decreases by the same proportion.
- A correlation coefficient,  $r$ , of **-1** means there is a perfect **negative** (downsloping) linear relationship between each value for  $x$  and its corresponding value for  $y$ . When  $x$  increases,  $y$  decreases by the same proportion; when  $x$  decreases,  $y$  increases by the same proportion.
- A coefficient of correlation,  $r$ , that is **close to zero** usually means there is very little or no relationship between the variables. However, in some cases it may mean that there is a strong relationship, but it is not a linear one. (You do not need to know how to recognize a non-linear relationship. Just be aware that non-linear relationships occur.)

A **high correlation coefficient**,  $r$ , is a number close to either  $+1$  or  $-1$ , and indicates a high degree of correlation. A high correlation coefficient means that simple linear regression analysis would be useful as a way of making a projection using a trend (regression) line. Generally, a correlation coefficient of  $\pm 0.50$  or higher indicates enough correlation that a linear regression can be useful for forecasting. The closer  $r$  is to  $\pm 1$ , the better the forecast should be.

- If  $r$  is a positive number **close to +1** (such as 0.83), this indicates that the data points follow a linear pattern fairly closely and the pattern is upsloping (for example, in a time series sales are increasing as the time moves forward). A forecast made from this data using simple regression analysis should be fairly accurate.

- If  $r$  is a negative number **close to  $-1$**  (such as  $-0.77$ ), this indicates that in a time series the data points follow a linear pattern, although less closely than in the previous example, and the pattern is downsloping instead of upsloping (for example, sales are decreasing as the time moves forward). A forecast made from this data using simple regression analysis would also be fairly accurate, though not as accurate as the previous example of an upsloping pattern, because the absolute number of  $0.77$  is lower than the absolute number of  $0.83$ . In other words,  $-0.77$  is further from  $-1$  than  $0.83$  is from  $+1$ .

A **moderate correlation** coefficient,  $r$ , (generally defined as  $\pm 0.30$  to  $\pm 0.49$ ) indicates a lower amount of correlation and questionable value of the historical data for forecasting.

A **low correlation coefficient**,  $r$ , (around  $\pm 0.10$ ) indicates that a forecast made from this data using simple regression analysis would not be useful.

The coefficient of correlation,  $r$ , does nothing to tell us **how much** of the variation in the dependent variable is explained by changes in the independent variable. It tells us only whether there is a direct (upsloping) or inverse (downsloping) relationship between the variables and the strength of that relationship.

**Note:** It is important to first **look at** the plotted data points on a graph when determining whether or not there is a relationship between the two variables. Do not rely on the value of the coefficient of correlation to indicate whether or not there is a relationship between the two variables because the coefficient of correlation will not detect non-linear relationships.

**Note:** The coefficient of correlation,  $r$ , can be **calculated in Excel** by entering the  $x$  values in one column (for example, Column A, rows 1-10), the  $y$  values in another column (for example, Column B, Rows 1-10), and entering the following formula in a blank cell:

**=CORREL(A1:A10,B1:B10)**

The correlation coefficient is also a part of the output of a regression analysis done in Excel, as we will see in the next few pages.

Since Excel is not available on the exam, **this is not something you will need to do on the exam**. This information is provided primarily to aid your understanding of the concept.

### The Coefficient of Determination ( $r^2$ )

In a simple linear regression with only one independent variable, the **coefficient of determination is the square of the coefficient of correlation**. The coefficient of determination is represented by the term  $r^2$  (or  $R^2$ ) and it is the **percentage of the total amount of change in the dependent variable ( $y$ ) that can be explained by changes in the independent variable ( $x$ )**.

$R^2$  is expressed as a number between 0 and 1. In a regression with a high coefficient of determination ( $r^2$ ), the data points will all lie close to the trend line. In a regression with a low  $r^2$ , the data points will be scattered at some distance above and below the trend line. The higher the  $r^2$ , the better the predictive ability of the linear regression. An  $r^2$  above 0.50 (50%) indicates that the forecast yielded by simple linear regression analysis should be meaningful.

### The T-Statistic

**The t-statistic, or t-value**, measures the degree to which the independent variable has a valid, long-term relationship with the dependent variable. The t-value for the independent variable used in a simple regression **should generally be greater than 2**. A value below 2 indicates little or no relationship between the independent variable and the dependent variable, and thus the forecast resulting from the regression analysis should not be used.

The t-statistic will be covered in more detail later and a formula for calculating it will be given.

### Performing the Regression Analysis

The statistical method used to perform simple regression analysis is called the **Least Squares**, also known as the **Ordinary Least Squares** method or **OLS**. If we call the **predicted value** of  $y$  obtained from the fitted line " $\hat{y}$ ," then the prediction equation, or the equation of a linear regression line, is:

$$\hat{y} = ax + b$$

Where:

- $\hat{y}$  = the **predicted** value of  $y$  on the regression line corresponding to each value of  $x$
- $a$  = the slope of the line
- $b$  = the  $y$ -intercept, or the value of  $y$  when  $x$  is zero (0)
- $x$  = the value of  $x$  on the  $x$ -axis that corresponds to the value of  $y$  on the regression line

The  **$y$ -intercept** is the point on the  $y$ -axis where the regression line begins. It is the point where the graph of the equation of the regression line crosses the  $y$ -axis. This point is at the far left side of the graph on the vertical axis, where the value of  $x$  is zero.

The **slope of the line** is how much the  $y$  value of the regression line changes (either increases or decreases) when the value of  $x$  increases by one unit. In a time series, a movement of one unit to the right on the  $x$ -axis, or a one-unit increase in  $x$ , represents the passage of one year.

**Note:** The equation of a linear regression line may be written in different ways, but  $x$  will always represent the independent variable and  $y$  will always represent the dependent variable.

The **coefficient of the independent variable**, or the **variable coefficient**, is whatever term is next to the  $x$  in the formula. This might be an  $a$ , as in the equation above, or the  $a$  and the  $b$  might be reversed and  $b$  might be next to the  $x$ . Regardless of which letter is next to the  $x$ , that term represents the **amount of increase in  $y$  for each unit of increase in  $x$** , or the **slope** of the line.

The **constant coefficient** is the letter that stands by itself, which is  $b$  in the equation above. It represents the  $y$ -intercept because this is the value of  $y$  when  $x$  is zero. The equation might also use  $a$  as the constant coefficient.

The right side of the equation may present the terms in any order. The constant coefficient may come first.

Thus the equation  $\hat{y} = a + bx$  is exactly the same as the equation  $\hat{y} = ax + b$ .

In the second equation, the coefficients are reversed and the order of the terms on the right side of the equation is reversed.

Remember to **look for the  $x$** . The term next to it will be the variable coefficient, or the amount of increase in  $y$  for each unit of increase in  $x$ . The term that is all by itself will be the constant coefficient and the  $y$ -intercept, or the value of  $y$  when  $x$  is zero.

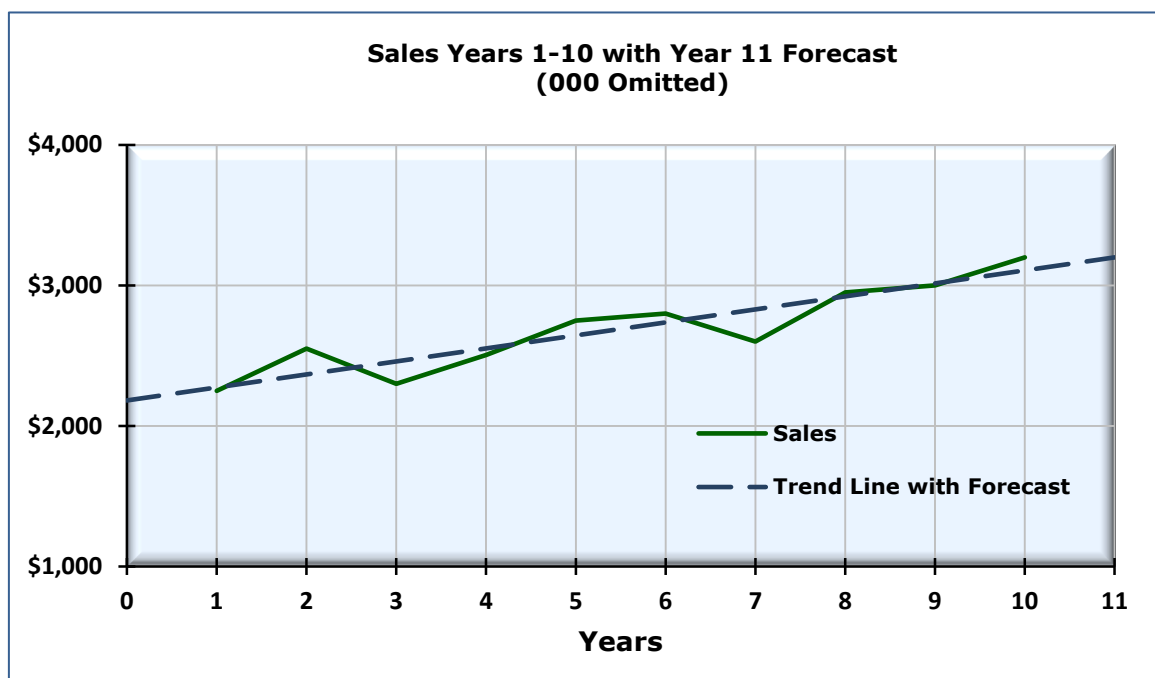
The symbol over the  $y$  in the formula is called a "hat," and it is read as "y-hat." The  $y$ -hat means that we are looking at the **predicted value** of  $y$ , not at the actual value of  $y$ . "Predicted" does not mean forecasted. The predicted value of  $y$  is the value of  $y$  on the regression line (the line created from the historical data) at any given value of  $x$ .

The following is an illustration of a time series regression analysis. We will use the same data that was used for the trend projection example earlier, but the years along the  $x$ -axis have been changed to 1, 2, 3, and so forth so that the regression can be calculated on the computer.

We will first create a graph of the historical sales data. Here are sales for ten consecutive years:

<u>Year</u>	<u>Sales</u>
1	\$2,250,000
2	\$2,550,000
3	\$2,300,000
4	\$2,505,000
5	\$2,750,000
6	\$2,800,000
7	\$2,600,000
8	\$2,950,000
9	\$3,000,000
10	\$3,200,000

Below is the graph. This was created using the "Charts" function in Microsoft Word. The trend (regression) line and projection for Year 11 were automatically calculated and added by Word using the historical data above.



The graph above indicates that there is a strong relationship between the passage of time (the x variables) and sales (the y variables). We can see that because the historical data points fall close to the trend line. Thus, a simple linear regression should yield a good forecast for Year 11 sales.

Therefore, we will proceed to the regression analysis. This regression analysis has been done in Excel using the Data Analysis ToolPak add-in.



**Note:** Because Excel is not available on the exam, performing analysis using Excel is *not something that you will need to do on the exam*. However, you do need to be able to interpret the output of a regression analysis and you may need to be able to calculate the T-Statistic, or T-Value, manually. The examples in the pages ahead of performing analysis in Excel are provided to help your understanding of the concepts and because we have received requests to explain how the trend lines used in the graphs presented in this topic were derived.

The Data Analysis ToolPak add-in must be loaded into Excel before it can be used. Loading it is done differently depending upon which version of Excel you have. Once it has been loaded, you will see it in "Data." If the add-in is not loaded, you can search the Help directory in your Excel software for "Load or Unload Add-In Programs." The Data Analysis ToolPak is available only in the Windows version of Excel.

**Mac users** can download for free an application called **StatPlus:mac LE** from AnalystSoft. For downloading instructions, search the Mac Excel Help on "I can't find the Analysis Toolpak." When used with the Mac version of Excel, StatPlus:mac LE produces a regression analysis report that is similar to the one produced in the Windows version of Excel by the Data Analysis ToolPak. It is used in a similar manner.

When the Data Analysis Toolpak add-in has been loaded into Excel for Windows, enter the input into a blank spreadsheet. Below is the data used for the graph as it would appear in the Excel spreadsheet. The independent variables (years 1 through 10) are in Column A and the dependent variables (sales) are in Column B. You can give headings to the data in the spreadsheet, but if you wish to provide headings do not include the cells containing the headings in the ranges to be analyzed for the regression. The dollar amounts are in thousands, with the 000 omitted.

	A	B
1	1	\$2,250
2	2	\$2,550
3	3	\$2,300
4	4	\$2,505
5	5	\$2,750
6	6	\$2,800
7	7	\$2,600
8	8	\$2,950
9	9	\$3,000
10	10	\$3,200

Next, launch the Data Analysis ToolPak in Excel. From the list of available analysis tools, choose "Regression." In the dialogue box that comes up,

- 1) Enter the dependent variable range into the field "Input Y Range." In our example, the dependent variables are in column B, so the range is \$B\$1:\$B\$10.
- 2) Enter the independent variable range into the field "Input X Range." In this example, the independent variables are in column A, so the range is \$A\$1:\$A\$10.
- 3) For "Output Options," choose "New Worksheet Ply:"
- 4) Click OK.



**Note:** This example was created in the Windows version of Excel 2007; other versions of Excel for Windows may have a different appearance or menu options.

A new sheet will be created in your workbook containing the output of the regression analysis. The new worksheet looks like the sheet below. The important values are highlighted in yellow and explained following the output:

## SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.914187681
R Square	0.835739116
Adjusted R Square	0.815206505
Standard Error	131.8849361
Observations	10

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	707973.4091	707973.4091	40.70301312	0.000213667
Residual	8	139149.0909	17393.63636		
Total	9	847122.5			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	2181	90.09456312	24.20789806	9.04399E-09	1973.241565	2388.758435	1973.241565	2388.758435
X Variable 1	92.63636364	14.52005358	6.379891309	0.000213667	59.15306007	126.1196672	59.15306007	126.1196672

The **y-intercept** is 2181. The regression line crosses the y-axis at \$2,181,000. You can verify on the graph created above the point where the regression line crosses the y-axis.

The **variable coefficient** (called "X Variable 1" above) is 92.63636364. This figure represents the slope of the line, showing how much the trend line increases annually. Since the input was in thousands, the output is also in thousands. Therefore, each year predicted sales on the trend line increase by \$92,636.

The **equation of the regression line** as shown in the Summary Output is:

$$\hat{y} = 92.636x + 2,181$$

The coefficients 92.636 and 2,181 are at the bottom of the Summary Output section under the heading "Coefficients."

This equation means that the regression line starts at \$2,181 (where x is zero), and each value on the trend line increases by \$92.636 over the previous year's trend line value. Thus, as we said above, for each year the trend of sales has increased by \$92,636.

**Forecasted sales for Year 11** according to this regression equation are:

$$\hat{y} = 92.636x + 2,181$$

$$\hat{y} = (92.636 \times 11) + 2,181$$

$$\hat{y} = 3,199.996$$

Since the numbers are in thousands of dollars (000 omitted), the result equals \$3,199,996, which is consistent with the point on the y-axis where the extension of the regression line aligns with Year 11 on the x-axis.

The **coefficient of determination**, or  $r^2$ , is 0.835739116. This is the percentage of the total amount of change in the dependent variable that can be explained by changes in the independent variable. Thus, the majority (83.57%) of changes in sales can be explained by the passage of time since this is a time series and time (i.e., years) is the independent variable. Furthermore, 16.43% (or 100% minus 83.57%) of the changes are unexplained by the passage of time and thus are the result of other factors. Remember, any result over 50% means that the forecast should be usable.

The **coefficient of correlation**,  $r$ , is 0.914187681. It is called "Multiple R" on the output sheet and is found at the top left of the output sheet. Because the regression line is upsloping, the coefficient of correlation is a positive number. If the regression line were downsloping instead, the coefficient of correlation would be a negative number. This  $r$ -value is very close to 1, indicating that there is a close correlation between the values of  $x$  and their related  $y$  values. In other words, the amount of change in  $y$  is well correlated with the amount of change in  $x$ . This confirms what is determined visually on the graph: regression analysis is a good method of forecasting sales for coming years.

The **t-statistic**, or **t-value**, is 6.379891309. The fact that this value is greater than 2 indicates a strong relationship between the independent variable and the dependent variable, and thus the forecast resulting from the regression analysis should be usable. This further confirms the information from the coefficient of determination and the coefficient of correlation.

### Calculating the T-Statistic

The t-statistic, or t-value, is given on the regression analysis output. But it can also be calculated manually using the other information available on the output. The formula for calculating the t-statistic is:

$$t = r \sqrt{\frac{N-2}{1-r^2}}$$

Where:  $N$  = Number of pairs of  $x$  and  $y$   
 $r$  = Correlation coefficient  
 $r^2$  = Coefficient of determination

For the above regression analysis, the calculated t-statistic is:

$$t = 0.914187681 \sqrt{\frac{10-2}{1-0.835739116}}$$

$$t = 0.914187681 \sqrt{\frac{8}{0.164260884}}$$

$$t = \underline{\underline{6.3798913}}$$

Since the calculated t-statistic matches the t-statistic in the regression output sheet, we know it has been calculated correctly.

The " $N - 2$ " in the above formula is called the **degrees of freedom**. The word "freedom" refers to the freedom of a number to have any possible value. When 10 pairs of numbers are used in determining the amount of correlation between the two members of each pair, the degrees of freedom equals  $10 - 2$ , or 8. Why?

Remember that the formula for the regression line is  $\hat{y} = ax + b$ . The regression line formula has two coefficients, or parameters:  $a$  and  $b$ . For any regression formula, the  $a$  and the  $b$  are given, and they cannot be changed. For example, in this regression,  $a = 92.636$  and  $b = 2,181$ . Those two numbers cannot vary. Therefore, each of those parameters costs one degree of freedom, and thus the degrees of freedom to use in calculating the t-value is the number of pairs minus 2. Here, that is  $10 - 2$ .

**Note:** For a simple linear regression, you do not need to have both the  $r$  (coefficient of correlation) and the  $r^2$  (coefficient of determination) in order to calculate the t-statistic manually. If you know one value, you can calculate the other. In a simple linear regression,  $r^2$  is the square of  $r$ , and  $r$  is the square root of  $r^2$ .

Question 92: Correlation is a term frequently used in conjunction with regression analysis, and is measured by the value of the coefficient of correlation,  $r$ . The best explanation of the value  $r$  is that it

- a) Is always positive.
- b) Interprets variances in terms of the independent variable.
- c) Ranges in size from negative infinity to positive infinity.
- d) Is a measure of the relative relationship between two variables.

(CMA Adapted)

### The Error Term and the Standard Error of the Estimate in Regression Analysis

On the regression graph above, we have two  $y$  values for each value of  $x$ : one is the actual historical value of  $y$  for that year, and the other is the estimated, or predicted, value of  $\hat{y}$  for that year, represented by the  $y$  value on the trend line aligned with each value of  $x$ . The difference between those two points is called the **error term**.

Remember that the equation of the regression line, or the line of “best fit” on the sales graph, is:

$$\hat{y} = ax + b$$

This equation, which is the simple linear regression model, gives us the **average** value of  $y$  (the response) for a given value of  $x$  (the predictor). The **average** response is the regression line. However, the actual observed data has responses that are not on the line itself, but rather they are **scattered around this line**.

This scatter is often called the **error**. The difference between the actual value of  $y$  and the estimated value of  $y$  for each value of  $x$  is called the **error term** for that value of  $x$ . The error term is represented by  $\epsilon$  (or *epsilon*). The  $\epsilon$  in the following model represents the scatter of the data around the line. If all of the data fell on the regression line, the error term would be zero.

In algebra, an equation such as  $y = 300x + 2,000$  means that  $y$  is exactly  $300x + 2,000$ . However, with regression data, the equation  $\hat{y} = 300x + 2,000$  is true **on average** but not true for a given value of  $x$ .

The equation for a **given value of  $x$**  is as follows:

$$y = ax + b + \epsilon$$

Where:  $y$  = the **dependent** variable

$a$  = the slope of the line, or the amount of change in  $y$  as a result of one unit of change in  $x$  (the variable coefficient)

$b$  = the  $y$ -intercept of the line

$x$  = the **independent** variable

$\epsilon$  = the **error term** for that value of  $x$ , which is the distance between the estimated  $\hat{y}$  value on the regression line for that value of  $x$  and the actual value of  $y$  for that value of  $x$ . The error term will be different for each value of  $x$  used in the regression function.

The inclusion of an error term in the regression model recognizes that:

- The regression model is imperfect,
- Some variables that help to “explain” the behavior of the dependent variable might not be included, and
- The included variables may have been measured with error.

There is always some component in the variation of the dependent variable that is completely random.

The **standard error of the estimate** (SEE) is an ordinary least squares estimate of the standard deviation of the underlying errors in the regression. The standard error of the estimate can give an indication of how well a linear regression works. It provides a comparison of the actual values of  $y$  that did occur historically to the estimated values of  $\hat{y}$  on the regression line. The estimated values of  $\hat{y}$  on the regression line are the values that result from putting the various values for  $x$  into the regression function and calculating the resulting value of  $y$  at each value of  $x$ .

In the regression output above, we see that the **standard error** is 131.8849361. This value can be calculated manually using the following formula:

$$S_{y,x} = \sqrt{\frac{\sum_{x=1}^N (Y_x - Y_{xEst})^2}{N - 2}}$$

By now, you should recognize that  $N - 2$  is the number of **degrees of freedom** in this regression. Here is the calculation of the standard error of the estimate for this regression:

<b>X</b>	<b>Y</b>	<b>Y<sub>Est</sub></b>	<b>Error Term (Y – Y<sub>Est</sub>)</b>	<b>Square Residuals (Y – Y<sub>Est</sub>)<sup>2</sup></b>
<b>1</b>	\$2,250	2,273.636	(23.636)	558.660496
<b>2</b>	2,550	2,366.272	183.728	33,755.977984
<b>3</b>	2,300	2,458.908	(158.908)	25,251.752464
<b>4</b>	2,505	2,551.544	(46.544)	2,166.343936
<b>5</b>	2,750	2,644.180	105.820	11,197.872400
<b>6</b>	2,800	2,736.816	63.184	3,992.217856
<b>7</b>	2,600	2,829.452	(229.452)	52,648.220304
<b>8</b>	2,950	2,922.088	27.912	779.079744
<b>9</b>	3,000	3,014.724	(14.724)	216.796176
<b>10</b>	3,200	3,107.360	92.640	8,582.169600
Sum of Square Residuals (SSR)				139,149.090960
Sum of Square Residuals (SSR) ÷ (N – 2)				17,393.636370
Standard Error of Estimate = $\sqrt{17,393.636370}$ =				<b><u>131.884936</u></b>

Since the calculated Standard Error of the Estimate matches the standard error calculated in the Excel regression output, we know the above calculation is correct.

The standard error of the estimate gives an indication of the predictive ability of the regression model. The lower the SEE is, the more accurate its predictions will be.

The **size of the standard error of the estimate** must be interpreted in relationship to the average size of the dependent variable. The units of the standard error may seem large (131.88 in this regression); however, in comparison to the average size of the dependent variable  $y$  (2,690.5 in this regression, calculated as the average of the 10 annual sales amounts), the percentage of error is small ( $131.88 \div 2,690.5 = 0.049$  or 4.9%). If the size of the standard error of the estimate is less than 5 to 10% of the average size of the dependent variable, we can be confident that the regression analysis is fairly precise.

In this regression, the size of the standard error of the estimate is 4.9% of the average size of the dependent variable. Since that is less than 5%, the size of the standard error is relatively small and we can be fairly confident that the regression analysis is precise.

Question 93: What coefficient of correlation results from the following data?

$X$	$Y$
1	10
2	8
3	6
4	4
5	2

- a) 0
- b) -1
- c) +1
- d) Cannot be determined from the data given.

(CIA Adapted)

### Inflation Adjustment in a Time Series Analysis

With a time series, especially one that covers a long period of time, the data can be distorted by the presence of inflation. For instance, sales occurring each year will contain an additional component representing the increase in the cost of that good simply as a result of inflation.

Therefore, we need a way to remove the portion of the sales each year that is attributable to price movements, leaving us with the change in the quantity of sales. Removing the portion of sales attributable to price movements will provide **inflation-adjusted** sales figures and an **inflation-adjusted** sales forecast.

Before looking at this process, we first need to understand some definitions:

- The **nominal** data is the data in the time series measured in the dollars that were current at the time each data point was captured. These dollars are affected by inflation.
- **Real** data is the inflation-adjusted time series data, with the effects of inflation removed. These are constant value dollars.
- In order to convert nominal data to real data, we need an appropriate **price index** that expresses the rate of inflation. The Consumer Price Index, the Producer Price Index, the Personal Consumption Expenditure Index and the GDP Deflator<sup>39</sup> are all commonly used as expressions of the inflation rate in the United States. (Other countries will have similar measurements for their respective economies, though the names may be different.) A price index measures the value of a basket of goods at a certain time relative to the value of the same basket in a base period. The price index is calculated by dividing the value of the basket in the year we are interested in by that same basket's value in the base year. The resulting ratio multiplied by 100 is the price index for that year.

With a time series, the price index figures for all years need to be "re-indexed" to set the base year's index to 100 and express each subsequent year's index in terms of the base year index. This re-indexing is done by dividing each year's price index by the base year's price index and multiplying by 100. To calculate the **real** values in a time series for a particular year, take the **nominal** values and divide each one by its "re-indexed" price index in decimal form.

(See Example C in the pages following.)

#### Formulas:

$$\text{Real Value} = \frac{\text{Nominal Value}}{\text{Current Price Index} / \text{Base Year's Price Index}}$$

OR

$$\text{Real Value} = \frac{\text{Nominal Value}}{1 + \text{Inflation Rate}}$$

<sup>39</sup> "GDP" stands for Gross Domestic Product. In economics, the Gross Domestic Product is the value of all the final goods and services produced in the domestic economy during a specific period.

Example A: First, use last year as the base year. Assume the Consumer Price Index last year was 149 and this year it is 151. The rate of inflation is 1.3%, calculated with the following formula:  $[(151/149) - 1]$ , or  $[1.013 - 1.000] = 0.013$  or 1.3%.

If the nominal value of sales for this year is \$1,000,000, to calculate the real value of sales for this year **in terms of last year** divide \$1,000,000 by 151/149 (1.013, the re-indexed price index in decimal form or 1 + the inflation rate).

$$\text{Real Value} = \frac{\$1,000,000}{1.013} = \$987,167$$

Using a period further back in time as the base year one and assuming the Consumer Price Index was 120 at that time, divide the nominal sales of the current period by 151/120, which is 1.258:

$$\text{Real Value} = \frac{\$1,000,000}{1.258} = \$794,913$$

When making forecasts, of course, we are not working with **this** year's inflation rate but rather with the **expected** inflation rate for the future year we are forecasting. To determine next year's real sales forecast, divide next year's nominal sales forecast by  $(1 + \text{the expected inflation rate})$ .

Example B: We anticipate next year's inflation rate will be 1%. Sales this year totaled \$100,000,000. Based on forecasts from the marketing department, we are anticipating **nominal** sales growth of 10% next year, meaning the dollar value of the sales will increase by 10%. However, since that 10% increase is nominal sales growth, it includes the effect of inflation. This dollar value of sales does not tell us what will happen to the quantity sold. The production department needs to know what **real** sales will be in order to produce the right quantity. What do we forecast **real** sales to be next year?

**Step 1: Nominal** sales next year (including inflation) are expected to be  $\$100,000,000 \times 1.10 = \$110,000,000$ .

**Step 2:** In order to calculate anticipated real sales for next year, the anticipated nominal sales need to be divided by the  $(1 + \text{inflation rate})$ :  $\$110,000,000 \div 1.01 = \$108,910,891$ .

**Real** sales (taking out the effect of inflation) will be \$108,910,891.

**Step 3:** To calculate the **real rate of sales growth**, divide real sales next year by actual sales this year and subtract 1.0:

$$\text{Real rate of sales growth} = \frac{\$108,910,891}{\$100,000,000} - 1.0 = 0.089 \text{ or } \underline{\underline{8.9\%}}$$

Alternately, we can calculate the real rate of sales growth using only the nominal rate and the inflation rate:

$$\text{Real rate} = \frac{1 + \text{Nominal Rate}}{1 + \text{Inflation Rate}} - 1.0$$

In the above example, the calculated real rate of sales growth is:

$$\text{Real rate of sales growth} = \frac{1.10}{1.01} - 1.0 = 0.089 \text{ or } \underline{\underline{8.9\%}}$$

Note that 8.9% is **not the same** as 10% minus the 1% inflation rate. The 8.9% is not much different from 10% minus 1%, but there is a small difference.

Furthermore, if we have the **real** rate and the **inflation** rate, we can find the **nominal** rate, using these equations:

$$\begin{aligned} &[(\text{Real rate} + 1) \times (\text{Inflation rate} + 1)] - 1 = \text{Nominal rate} \\ &[(0.089 + 1.000) \times (0.01 + 1.000)] - 1 \\ &= (1.089 \times 1.01) - 1 \\ &= 1.10 - 1 = \underline{\underline{0.10}} \text{ or } \underline{\underline{10\%}} \end{aligned}$$

To deflate several years of time series sales figures to the base year values, start by dividing each year's price index by the price index of the base year to get a "re-indexed" price index for each year. Then divide the nominal sales figure for each year by its re-indexed price index to get the real sales in terms of the base year.

Example C: Here are the sales figures for the 10 years that we used for the previous regression analysis, deflated to the base year of Year 1. Note that the first year's price index is not 100. When we re-index, we **make** the first year's re-indexed price index equivalent to 100.

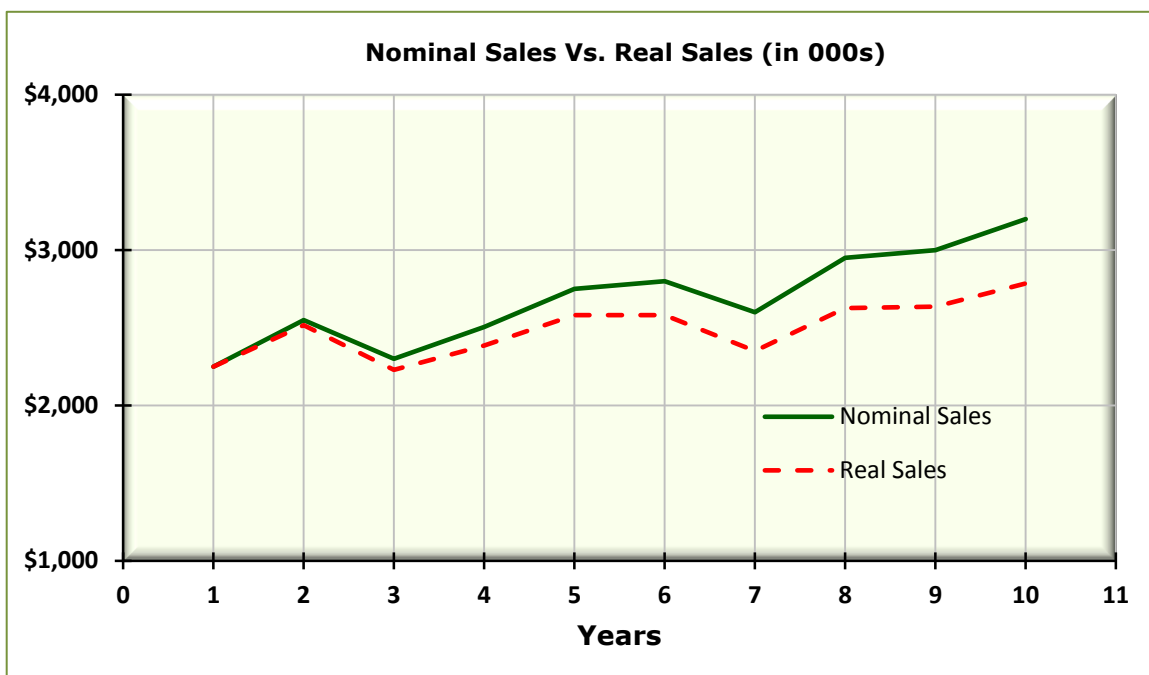
<u>Year</u>	<u>Nominal Sales (in 000s)</u>	<u>CPI</u>	<u>Re-indexed</u>	<u>Decimal</u>	<u>Real Sales (in 000s)</u>
<b>1</b>	2,250	115.6	100.0 <sup>1</sup>	1.000	2,250
<b>2</b>	2,550	117.1	101.3 <sup>2</sup>	1.013	2,517 <sup>3</sup>
<b>3</b>	2,300	119.3	103.2	1.032	2,229
<b>4</b>	2,505	121.4	105.0	1.050	2,386
<b>5</b>	2,750	123.1	106.5	1.065	2,582
<b>6</b>	2,800	125.4	108.5	1.085	2,581
<b>7</b>	2,600	127.8	110.6	1.106	2,351
<b>8</b>	2,950	129.8	112.3	1.123	2,627
<b>9</b>	3,000	131.5	113.8	1.138	2,636
<b>10</b>	3,200	132.8	114.9	1.149	2,785

<sup>1</sup>  $(115.6 \div 115.6) \times 100$

<sup>2</sup>  $(117.1 \div 115.6) \times 100$

<sup>3</sup>  $2,550 \div 1.013$

When the sales data is "deflated," as above, we see that real sales growth has not been as great as nominal sales growth. The two sales lines on the graph below illustrate the difference. Note that the difference becomes greater with each passing year. The increase in the difference between the two lines over time is caused by the fact that the inflation adjustments are cumulative, since we are expressing sales for each year in terms of the **base year**, not in terms of the year previous to it.





## Causal Forecasting

Causal forecasting methods are used when we can determine that the value we are forecasting is affected by some other value. If we can identify a **cause-and-effect relationship** between the other value and the value we are forecasting and if that relationship is a linear one, we can use a projection of the other value (as the independent variable) to forecast the value we are interested in (the dependent variable).

**Note:** The two basic assumptions of simple regression analysis are:

- 1) Changes in the value of the dependent variable can be explained by changes in the level of the independent variable; and
- 2) The **relationship** between the dependent variable and the independent variable is **linear**. That is, a graph of the two variables, with the independent variable on the x-axis and the dependent variable on the y-axis, will result in a **straight line** within the relevant range.

For example, if we know that the level of sales is directly related to the level of advertising, we can forecast sales once we know the future level of advertising. Therefore, once the advertising budget has been set, we can use planned advertising expenditures to forecast sales.

How do we know whether or not there is a relationship between advertising expenditures and sales? We use regression analysis, as described in the preceding section. **Simple regression analysis is used for both trend projection and in causal forecasting.** In trend projection, we use time as the independent variable. In causal forecasting, we use as the independent variable something that may have a cause-and-effect relationship to that which is being forecast.

A cause-and-effect relationship between the two variables must first be determined. Simple regression analysis and correlation analysis help us to determine whether there is a linear relationship between the two variables and whether the relationship is strong enough to make causal forecasting a valid method to develop a forecast.

Regression analysis for causal forecasting is done the same way as time series trend projection but instead of using time as the independent variable, we use some other type of data as the independent variable to forecast the dependent variable. For example, we might use advertising expenditures as the independent variable to forecast sales, since advertising usually drives sales.

Accordingly, we will use historical advertising expenditures and sales for three different companies in the examples that follow to illustrate how regression analysis can tell us whether there is a strong enough correlation between the two variables to use advertising expenditures to forecast sales. Historical information on advertising expenditures will be the independent variable on the x-axis and sales will be the dependent variable on the y-axis. In our examples, we will graph the relationships and do simple regression analysis with correlation analysis to determine whether there is a linear relationship between the two variables and whether it is strong enough to enable a good forecast based on the historical data.

**Note:** Always remember that correlation does not necessarily mean causation. Two variables may be highly correlated historically, but if there is no actual cause-and-effect relationship between them, the independent variable will not be a good predictor of the dependent variable.

For example, there may be a high degree of correlation between a homeowner's electric utility bill and the household's level of ice cream consumption. But logically, there is no cause-and-effect relationship between the two. Instead, a third factor (such as outside temperature) might more likely be affecting both. Always consider whether a cause-and-effect relationship exists between the two variables when doing causal forecasting.

Advertising expenditures usually do have a cause-and-effect relationship to sales, so the question of actual causation is not a concern in the following examples. As long as historical advertising expenditures and historical sales are reasonably well correlated, advertising expenditures should be a good independent variable to use to forecast sales.

### Simple Linear Regression Analysis in Causal Forecasting

Although advertising expenditures usually do correlate to sales, we cannot just assume that they do. We can use correlation analysis to check whether advertising expenditures have historically correlated with sales. We will illustrate this with three very different examples: Firm A, where the correlation is strong; Firm B, where the correlation is weaker; and Firm C, where there is little or no correlation.

#### Firm A: A strong relationship between advertising expenditures and sales.

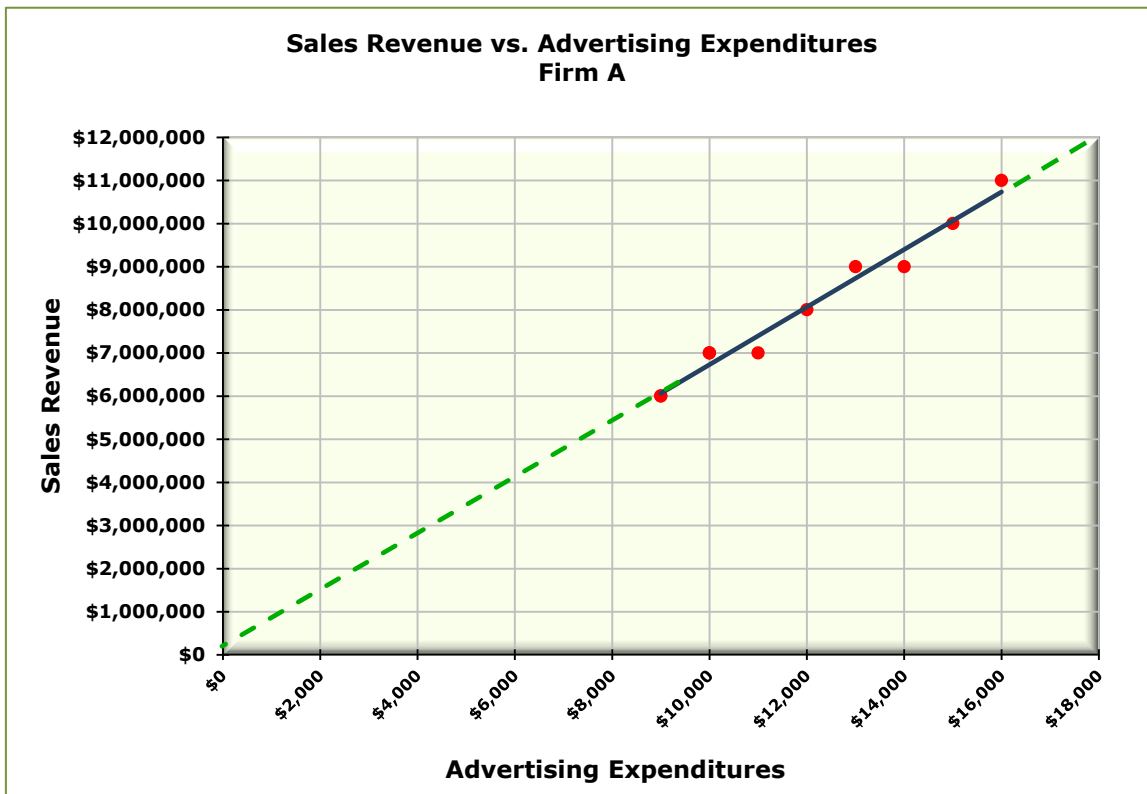
Here are advertising expenditures and sales for 10 consecutive years for Firm A. Unlike the time series, the sequence of the data (in years) is not important when we graph these data points. In fact, the years could be in a random chronological order. For example, there is no reason why the year with \$13,000 in advertising expenditures needs to follow the year with \$15,000 in advertising expenditures.

<b>Advertising Expenditures (x)</b>	<b>Sales (y)</b>
\$15,000	\$10,000,000
13,000	9,000,000
16,000	11,000,000
10,000	7,000,000
9,000	6,000,000
11,000	7,000,000
14,000	9,000,000
10,000	7,000,000
12,000	8,000,000
9,000	6,000,000

The graph for Firm A's advertising expenditures and sales that follows, called a **scatter plot graph**, shows advertising expenditures as the independent variable on the x-axis and sales as the dependent variable on the y-axis. The points on the following scatter plot graph do not represent sequential years' history in the manner of a time series graph. The points represent the various relationships that occurred during the past 10 years between advertising expenditures in any given year and sales revenue during the same year. Each pair of x and y (and thus each point) represents the point where one set of historical advertising expenditures and sales intersects. Because the data table above details historical relationships, we could put the rows of the data table in any order and the resulting graph would be the same.

Another difference between a scatter plot graph and a time series graph is that a single point on a scatter plot graph does not necessarily represent only one year's history. During two separate years, advertising expenses were \$9,000 and sales were \$6,000,000. On the scatter plot graph, one single point where \$9,000 and \$6,000,000 intersect represents both those years. Similarly, the two years when advertising expenditures were \$10,000 and sales were \$7,000,000 are represented by only one data point on the graph at the intersection of \$10,000 and \$7,000,000.

If the data had included two years with advertising expenses of \$9,000 but with different sales amounts, we would see two points on Firm A's graph above the \$9,000 on the x-axis, representing the two different sales levels at that level of advertising expenditures. We will see that on the other graphs that follow this one.



The solid blue segment of the regression line represents the predicted sales if advertising expenditures are in the range they have historically been (\$9,000 to \$16,000). The two green, dashed line segments on either side of the regression line represent predicted values for sales at various other levels of advertising expenditures. The green dashed segments are extensions of the regression line.

On the following page is a reproduction of the output from Excel showing the y-intercept, the slope of the regression line, the coefficient of determination, the coefficient of correlation, and the t-statistic for the regression on Firm A's graph.

The regression analysis output from Excel for Firm A:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.987963248
R Square	0.97607138
Adjusted R Square	0.973080303
Standard Error	278869.1701
Observations	10

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	2.53779E+13	2.53779E+13	326.3276836	9.05166E-08
Residual	8	6.22144E+11	77768014060		
Total	9	2.6E+13			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	52724.07733	448689.3327	0.1175068666	0.909355036	-981955.3783	1087403.533	981955.3783	1087403.533
X Variable 1	667.8383128	36.96956761	18.06454216	9.05166E-08	582.5863371	753.0902885	582.5863371	753.0902885

The **y-intercept** is 52724.07733. The extended regression line crosses the y-axis at nearly zero on the y-axis. On Firm A's graph, where the increments on the y-axis are in millions, \$52,724 is nearly zero.

The **variable coefficient** ("X Variable 1") is 667.8383128, which is the slope of the line, or how much the predicted sales increase for each 1-unit increase in advertising expenditures. This means:

- For each \$1 increase in advertising expenditures, expected sales on the regression line increase by \$667.84.
- For each \$2,000 increase in advertising expenditures, expected sales increase by \$667.84 × 2,000, or \$1,335,680.
- Since advertising expenditures on the x-axis of Firm A's graph are labeled in increments of \$2,000, for each vertical grid line on the graph the regression line increases by \$1,335,680 on the y-axis.

The **equation of the regression line**, as shown in the Summary Output from Excel above (rounded), is:

$$\hat{y} = 667.84x + 52,724$$

The y-intercept and variable coefficient are at the bottom of the Summary Output section under the heading "Coefficients."

For example, at the point on the x-axis where advertising expenditures are \$10,000, the predicted sales are \$6,731,124:

$$\hat{y} = 667.84(10,000) + 52,724$$

$$\hat{y} = 6,731,124$$

You can look at the regression line on Firm A's graph and see that the line intersects with \$10,000 on the x-axis at approximately \$6,731,124 on the y-axis.

If advertising expenditures are \$18,000, predicted sales according to this regression are \$12,073,844:

$$\hat{y} = 667.84(18,000) + 52,724$$

$$\hat{y} = 12,073,844$$

The **coefficient of determination**,  $r^2$ , is 0.97607138. This is the percentage of the total amount of change in the dependent variable that can be explained by changes in the independent variable. Thus, 97.61% of the changes in sales can be explained by the amount of advertising expenditures. It also means that just 2.39% (100% – 97.61%) of the changes are **not** explained by the amount of advertising expenses and thus are the result of other factors.

The **coefficient of correlation**,  $r$  ("Multiple R"), is 0.987963248. Because the regression line is upsloping, the coefficient of correlation is a positive number. If the regression line sloped downward instead, the coefficient of correlation would be a negative number. This  $r$ -value is very close to 1, indicating the correlation between the values of  $x$  and their related  $y$  values is very close. In other words, the amount of change in  $y$  is well correlated with the amount of change in  $x$ , confirming that advertising expenses are a good way to forecast sales as long as there is reason to believe that there is a cause-and-effect relationship between the two variables.

The **t-statistic**, or **t-value**, on the output is 18.06454216. Since this value is greater than 2 (indeed, quite a bit greater), it indicates a strong relationship between advertising expenditures (the independent variable) and sales (the dependent variable), and thus the forecast resulting from the regression analysis should be fairly accurate. The t-statistic further confirms the close correlation between advertising expenditures and sales at Firm A.

Remember that the t-statistic, or t-value, can be calculated manually when we know the value of  $r$  and/or  $r^2$ . The formula for calculating the t-statistic is:

$$t = r \sqrt{\frac{N-2}{1-r^2}}$$

Where:      $N$  =            Number of pairs of  $x$  and  $y$   
                 $r$  =            Correlation coefficient  
                 $r^2$  =            Coefficient of determination

For the above regression analysis for Firm A, the calculated t-statistic is:

$$t = 0.987963248 \sqrt{\frac{10-2}{1-0.97607138}}$$

$$t = 0.987963248 \sqrt{\frac{8}{0.02392862}}$$

$$t = \underline{\underline{18.064542}}$$

Note that the calculated t-statistic matches the t-statistic on the Excel regression output, confirming that it has been calculated correctly.

Based on this analysis, advertising expenditures would be a very good independent variable to use for causal forecasting of sales.

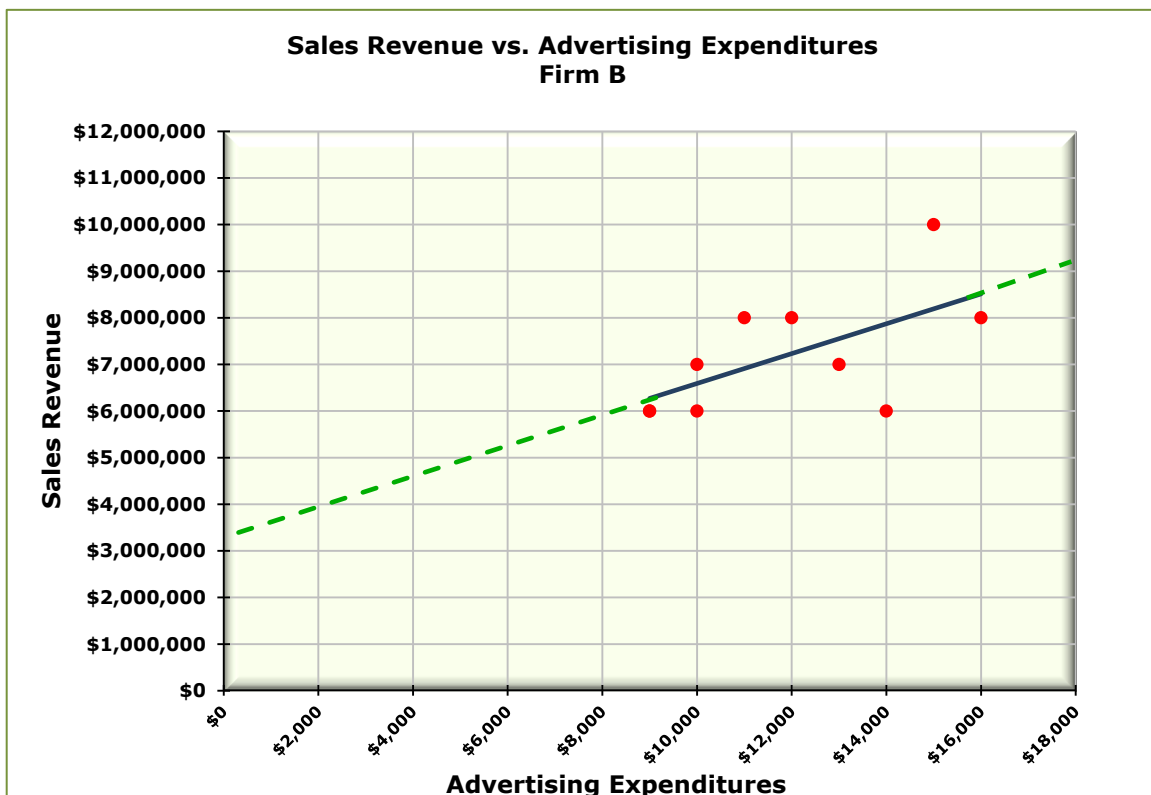
Next, we'll look at an example of a weaker relationship between advertising expenditures and sales.

**Firm B: A weaker relationship between advertising expenditures and sales.**

Below is historical information on advertising expenditures and sales for Firm B, also for 10 consecutive years. Advertising expenditures are the same as they were for Firm A. However, for Firm B there is less correlation between advertising expenditures and sales.

<b>Advertising Expenditures (x)</b>	<b>Sales (y)</b>
\$15,000	\$10,000,000
13,000	7,000,000
16,000	8,000,000
10,000	6,000,000
9,000	6,000,000
11,000	8,000,000
14,000	6,000,000
10,000	7,000,000
12,000	8,000,000
9,000	6,000,000

Here is the scatter plot graph:



In the same way that we drew a regression line on Firm A's graph, we have drawn a regression line on Firm B's graph. However, the historical data points are more scattered and not as close to the regression line on Firm B's graph as they were on Firm A's graph. In statistical terminology, the data points are **more widely dispersed**.

The regression analysis output from Excel for Firm B is reproduced below.

## SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.610875849
R Square	0.373169303
Adjusted R Square	0.294815466
Standard Error	1105585.754
Observations	10

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	5.821E+12	5.82144E+12	4.762616822	0.060640659
Residual	8	9.77856E+12	1.22232E+12		
Total	9	1.56E+13			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	3393673.111	1778843.226	1.907797754	0.092845775	-708346.72	7495692.941	-708346.72	7495692.941
X Variable 1	319.8594025	146.5670345	2.18234205	0.060640659	-18.12478485	657.8435898	-18.12478485	657.8435898

The **y-intercept** is 3393673.111. The extended regression line crosses the y-axis at \$3,393,673.

The **variable coefficient** ("X Variable 1") is 319.8594025, which is the slope of the line, or how much the predicted sales increase for each 1-unit increase in advertising expenditures. For each \$1 increase in advertising expenditures, predicted sales on the regression line increase by \$319.86. Since advertising expenditures on the x-axis of Firm B's graph are labeled in increments of \$2,000, for each vertical grid line on the graph the regression line increases by \$639,719 on the y-axis ( $319.8594025 \times \$2,000$ , rounded).

The **equation of the regression line**, as shown in the Summary Output from Excel above (rounded), is:

$$\hat{y} = 319.86x + 3,393,673$$

For example, at the point on the x-axis where advertising expenditures are \$10,000, the predicted sales are \$6,592,273:

$$\hat{y} = 319.86(10,000) + 3,393,673$$

$$\hat{y} = 6,592,273$$

If advertising expenditures were \$18,000, sales would be predicted to be \$9,151,153 according to this regression:

$$\hat{y} = 319.86(18,000) + 3,393,673$$

$$\hat{y} = 9,151,153$$

The **coefficient of determination**,  $r^2$ , is 0.373169303. This is the percentage of the total amount of change in the dependent variable that can be explained by changes in the independent variable. Only 37.32% of the changes in sales can be explained by the amount of advertising expenditures. If you recall, an  $r^2$  of 50% or above indicates that the data should yield a usable forecast. This  $r^2$  is below 50%. Furthermore, 62.68%

(100% minus 37.32%) of the changes are **not** explained by the amount of advertising expenses and thus are the result of other factors.

The **coefficient of correlation,  $r$** , ("Multiple R") is 0.610875849. It is a positive number because the regression line is upsloping. This  $r$ -value is not very close to 1. It is greater than 0.50, and generally a correlation coefficient greater than  $\pm 0.50$  indicates enough correlation to result in a usable forecast. However, the correlation is weak in comparison to the correlation in Firm A's data. A correlation coefficient of 0.610875849 does not provide a strong confirmation that this data set is a good one for making forecasts.

The **t-statistic**, or **t-value**, from the Excel regression output is 2.18234205. It is greater than 2, but only slightly greater, confirming the weak relationship between advertising expenditures and sales.

For Firm B's regression analysis, the calculated t-statistic is:

$$t = 0.610875849 \sqrt{\frac{10 - 2}{1 - 0.373169303}}$$

$$t = 0.610875849 \sqrt{\frac{8}{0.626830697}}$$

$$t = \underline{\underline{2.182342}}$$

Our next firm has virtually no correlation between its advertising expenditures and its sales.

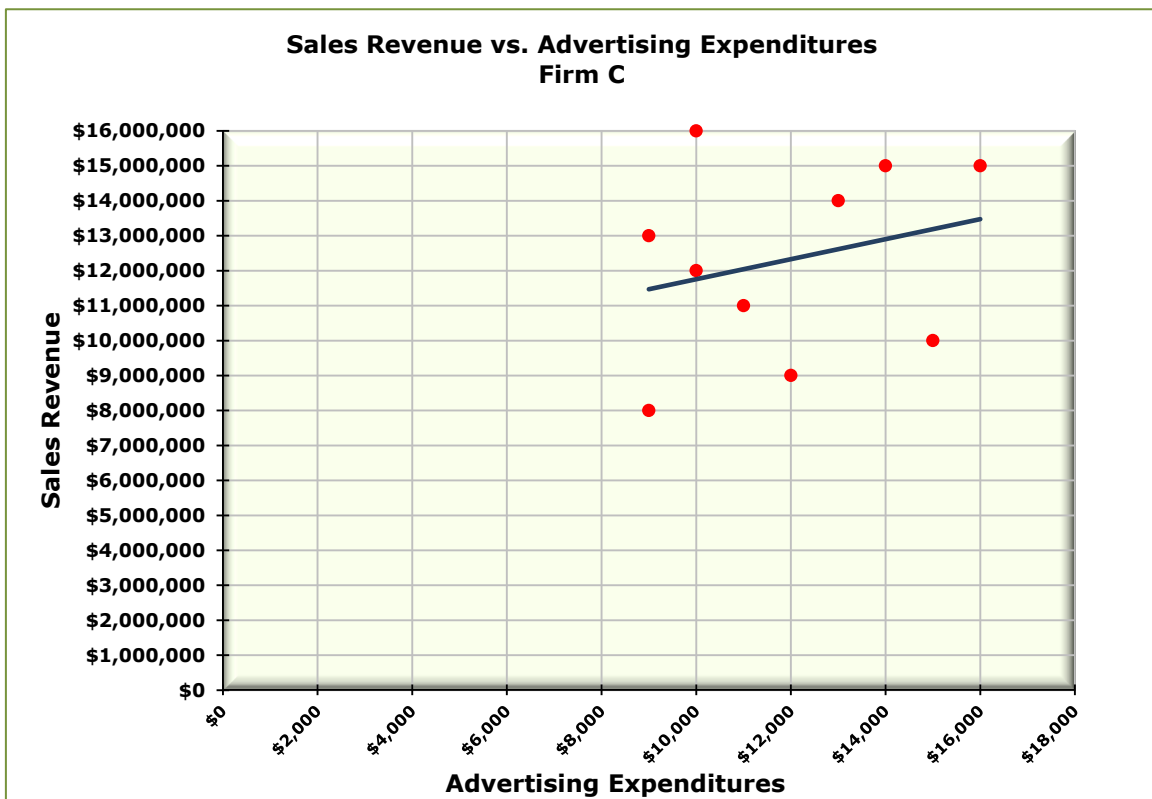
#### **Firm C: Little or no relationship between advertising expenditures and sales.**

The following data for Firm C demonstrate virtually no relationship between advertising expenditures and sales. As with the previous two examples, these figures are for 10 consecutive years. Advertising expenditures are the same as for Firm A and Firm B but sales are different.

<b>Advertising Expenditures (x)</b>	<b>Sales (y)</b>
\$15,000	\$10,000,000
13,000	14,000,000
16,000	15,000,000
10,000	16,000,000
9,000	13,000,000
11,000	11,000,000
14,000	15,000,000
10,000	12,000,000
12,000	9,000,000
9,000	8,000,000



Here is the scatter plot graph:



When we look at the data points in relation to the regression line on Firm C's graph, we see that there is really no relationship between advertising expenditures and sales revenues for Firm C. The data points are all over the graph and are nowhere near the regression line. We have not even attempted to extend the line to the y-axis or out further on the x-axis because any predicted values would be meaningless. It is clear that advertising expenditures are not a good predictor of sales for Firm C. Although the above graph is all that is needed to make this determination, we will perform the regression analysis in Excel in order to show what little to no correlation looks like in the regression output.

Advertising expenditures were \$9,000 during two different years. During one of those years, sales were \$13,000,000, while in the other year sales were only \$8,000,000. The same thing occurred when advertising expenditures were \$10,000 during two separate years. Note that on Firm C's graph two different points on the y-axis are aligned with \$9,000 on the x-axis, and two different points on the y-axis are aligned with \$10,000 on the x-axis.

The ability to have more than one y value for each value of x is another way in which a causal forecasting graph is different from a time series graph. A time series graph can have only one y value for each x value. For instance, if the time series graph represents annual sales, there can be only one sales figure for each year. But on a causal forecasting graph, the x-axis does not represent time. Therefore, more than one y value can exist for each x value.

Below is the regression analysis output for Firm C from Excel:

## SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.261853218
R Square	0.068567108
Adjusted R Square	-0.047862004
Standard Error	2815816.488
Observations	10

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	4.66942E+12	4.66942E+12	0.588917212	0.464882168
Residual	8	6.34306E+13	7.92882E+12		
Total	9	6.81E+13			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	8891036.907	4530536.023	1.96246909	0.085331691	-1556397.888	19338471.7	-1556397.888	19338471.7
X Variable 1	286.4674868	373.2915975	0.767409416	0.464882168	-574.34448	1147.279454	-574.34448	1147.279454

The **y-intercept** on the regression output for Firm C is 8891036.907. If we had extended the regression line out to the y-axis on Firm C's graph, the extended regression line would have crossed the y-axis at \$8,891,037.

The **variable coefficient** ("X Variable 1") is 286.4674868, which is the slope of the line, or how much the regression line increases for each 1-unit increase in advertising expenditures. For each \$1 increase in advertising expenditures, predicted sales on the regression line increase by \$286.47.

The **equation of the regression line**, as shown in the output from Excel above (rounded), is:

$$\hat{y} = 286.47x + 8,891,037$$

We will not bother to calculate predicted sales on the basis of this equation, since the correlation between the independent and the dependent variables in this set of data is not strong enough for a predicted sales figure to be meaningful.

The **coefficient of determination**,  $r^2$ , is 0.068567108. This figure represents the percentage of the total amount of change in the dependent variable that can be explained by changes in the independent variable, and it is extremely low. Only 6.86% of the changes in sales can be explained by the amount of advertising expenditures, so 93.14% of the changes (100% minus 6.86%) are the result of other factors.

The **coefficient of correlation**,  $r$ , ("Multiple R") is 0.261853218. The positive number indicates that the regression line is upsloping. This  $r$ -value is well below 0.50, an indication of virtually no correlation between the values of  $x$  and their related  $y$  values.

The **t-statistic**, or **t-value**, is 0.767409416 on the Excel output. It is much less than 2, confirming the lack of a useful relationship between advertising expenditures and sales.

For the above regression analysis, the calculated t-statistic is:

$$t = 0.261853218 \sqrt{\frac{10 - 2}{1 - 0.068567108}}$$

$$t = 0.261853218 \sqrt{\frac{8}{0.931432892}}$$

$$t = \underline{\underline{0.767409416}}$$

### Multiple Regression Analysis in Causal Forecasting

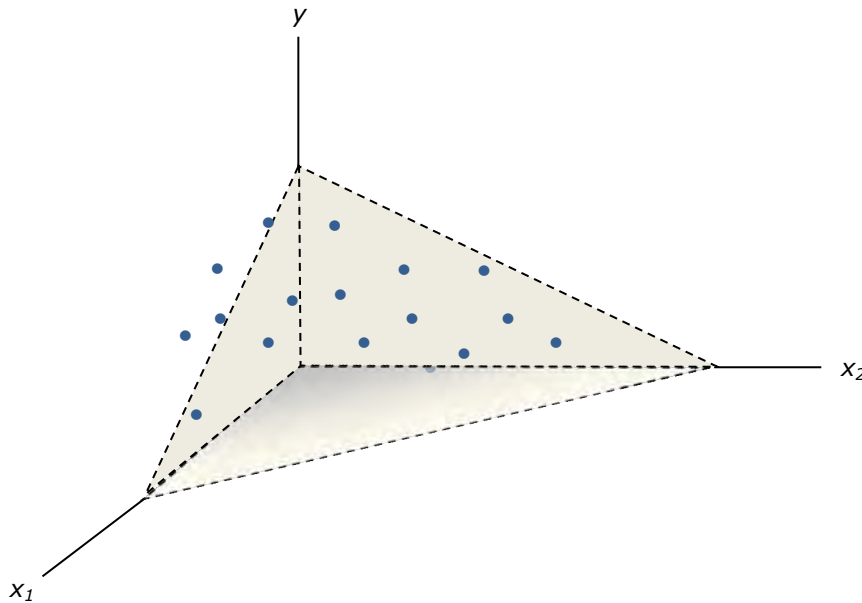
If only one independent variable (such as advertising expenditures) is affecting the dependent variable (such as sales) and if the relationship between them is linear, regression analysis is called simple linear regression. However, it is also possible for the dependent variable such as sales to be affected by **more than one** independent variable. Advertising expenditures, the size of the sales staff, competition, the economy, or any number of other circumstances can impact sales. When more than one independent variable is known to impact sales and each one can be expressed numerically, regression analysis using all of the independent variables to forecast the dependent variable is called **multiple regression analysis**. Multiple regression analysis is another type of causal forecasting.

For example, demographic data may be used to forecast sales for a new retail store that is being planned. If we have previously opened new outlets in other areas, we can use demographic data from those areas and relate it to sales results in the new retail store. The size of the population, the population's socio-economic level, age breakdown, and many other factors can be used as independent variables in relating actual sales levels experienced in other areas to demographic information for those areas. If we find a linear relationship or relationships **that are causal**, we can then use that demographic information for the new area to forecast its sales levels.

If we find **several** demographic factors that are accurate predictors, we can use them in a **multiple regression analysis**.

**Note:** Remember that there must be a reasonable basis to assume a cause-and-effect relationship between the independent variable(s) and the dependent variable. If there is no reason for a connection, any correlation found through the use of regression analysis is accidental. **A linear relationship does not prove a cause-and-effect relationship, and correlation does not prove causation.**

The simple regression analyses we illustrated previously were in single geometric planes. The graph of a multiple regression analysis will have three or even more dimensions (that is, a dimension, or x-axis, for each independent variable). Here is an illustration of a multiple regression analysis with two independent variables and two x axes,  $x_1$  and  $x_2$ :



The equation of this three-dimensional multiple regression function is:

$$\hat{y} = a_1x_1 + a_2x_2 + b$$

Where:

- $\hat{y}$  = the **predicted** value of  $y$  on the regression line corresponding to each value of  $x_1$  and  $x_2$
- $a_1, a_2$  = variable coefficients, similar to the slope of the line
- $b$  = the constant coefficient, the  $y$ -intercept, and the value of  $y$  when  $x_1$  and  $x_2$  are zero
- $x_1$  = the value of  $x$  on the  $x_1$  axis that corresponds to the value of  $y$  on the regression line
- $x_2$  = the value of  $x$  on the  $x_2$  axis that corresponds to the value of  $y$  on the regression line

As in simple regression, this formula may be written in different ways. In fact, the formula is usually used with either all "a"s or all "b"s, with a subscripted zero (0) to indicate the constant coefficient. It is presented above using both "a" and "b" in order to be consistent with the way the simple regression function was presented earlier. However, it is frequently represented as follows:

$$\hat{y} = a_0 + a_1x_1 + a_2x_2$$

Where  $a_0$  is the constant coefficient and it appears at the beginning instead of at the end.

Or as:

$$\hat{y} = b_0 + b_1x_1 + b_2x_2$$

Where  $b_0$  is the constant coefficient and it appears at the beginning instead of at the end.

It could also be written as:

$$\hat{y} = \beta_0 + \beta_1x_1 + \beta_2x_2$$

Where  $\beta_0$  is the constant coefficient and it appears at the beginning instead of at the end.

The constant coefficient usually appears at the beginning of the right side of the equation for a multiple regression analysis function (instead of at the end, as in a simple regression equation) because a multiple

regression equation can have an infinite number of independent variables. To indicate that infinite number of independent variables, the equation would be written like the one below. This equation uses “b”s for all of the variables, although “a”s could also be used:

$$\hat{y} = b_0 + b_1x_1 + b_2x_2 + \dots + b_kx_k$$

Again, look for the x terms and for the term without an x. The x terms will be the variable coefficients and the term without any x will be the constant coefficient.

### Evaluating the Reliability of a Multiple Regression Analysis

In the discussion of simple regression analysis, we said that the **coefficient of determination,  $r^2$** , is the percentage of the total amount of change in the **dependent** variable that can be explained by changes in the **independent** variable. Thus,  $r^2$  is an indicator of the reliability of a simple regression analysis. If  $r^2$  is above 0.50 or 50%, then the regression is fairly reliable because the regression can be used to predict that percentage of the total variation in the dependent variable. The higher the  $r^2$  is, the better.  $R^2$  is used as an indicator of the reliability of a multiple regression analysis, just as it is used in a simple regression analysis. The  $r^2$  value evaluates the whole regression, including all of the independent variables used.

Like simple regression analysis, multiple regression analysis also uses the **t-value**—actually t-values (plural)—to evaluate the reliability of each individual independent variable as a predictor of the dependent variable. A separate t-value is calculated for each of the individual independent variables in the multiple regression, and each independent variable is evaluated individually. The t-value for each independent variable evaluates the **contribution** of that independent variable to the multiple regression analysis.

**The t-value for every independent variable used in a multiple regression should generally be greater than 2, the same as in simple regression analysis.** A t-value below 2 indicates little or no relationship between the independent variable and the dependent variable; thus, that independent variable should not be used for causal forecasting in a multiple regression.

As with simple regression, the  $r^2$  and the t-values are computer-calculated and they are based on the input supplied for the independent variables and the dependent variable.

Before using each independent variable in the multiple regression analysis, **each** independent variable being considered should be evaluated by an individual simple regression analysis. Examine the output for each, particularly the **coefficient of correlation,  $r$** , and the **coefficient of determination,  $r^2$** . This evaluation will be similar to the evaluation done when we were when working with one independent variable

If this evaluation is done **before running the multiple regression**, and if only those independent variables that are highly correlated with the dependent variable are used in the multiple regression, the t-values that result from the multiple regression should all be greater than 2. If, however, one or more of the t-values are below 2, then those independent variables should be eliminated and the multiple regression run again, even if the  $r^2$  for the whole regression is high (for example, 0.85).

**Note:** Remember, correlation does not prove causation. In addition to a strong correlation between each independent variable and the dependent variable, there must be a logical cause-and-effect relationship between them before the independent variable can be used effectively to predict the dependent variable.

If the coefficient of determination, or  $r^2$ , is only 0.50 for a multiple regression analysis (which is low but acceptable), the multiple regression might be used to predict 50% of the variation in the dependent variable, but only **if the t-values for all the independent variables are greater than 2**).

Multiple regression can be done in Excel using the Data Analysis Toolpak. The only difference in input from simple regression analysis is that more than one column on the Excel spreadsheet is included in the “Input X Range” (that is, one column of data for each independent variable). For this reason, the columns containing the independent variables must be contiguous (next to one another) in the spreadsheet. The  $r^2$  is the most important item in the output, as it evaluates the whole regression.

### Benefits and Limitations of Regression Analysis

The **benefits** or **advantages** of regression analysis are:

- Regression analysis is a quantitative method and as such it is objective. A given data set generates specific results. The results can be used to draw conclusions and make forecasts.
- Regression analysis is an important tool for budgeting and cost accounting. In budgeting, it is virtually the only way to compute fixed and variable portions of costs that contain both fixed and variable components (**mixed** costs). The use of regression analysis for computing fixed and variable portions of mixed costs will be covered later.

The **shortcomings** or **limitations** of regression analysis are:

- To use regression analysis, historical data is required for the variable that is being forecast or for the variables that are causal to this variable. If historical data is not available, regression analysis cannot be used.
- Even when historical data is available, its use is questionable for predicting the future if a significant change has taken place in the conditions surrounding that data.
- In causal forecasting, the usefulness of the data generated by regression analysis depends upon the choice of independent variable(s). If the choice of independent variable(s) is inappropriate, the results can be misleading.
- The statistical relationships that can be developed using regression analysis are valid only for the range of data in the sample.

Question 94: In regression analysis, which of the following correlation coefficients represents the strongest relationship between the independent and dependent variables?

- a) 1.03
- b) -0.02
- c) -0.89
- d) 0.75

(CIA Adapted)

**The following information is for the next two questions:** In preparing the annual profit plan for the coming year, Wilkens Company wants to determine the cost behavior pattern of the maintenance costs. Wilkens has decided to use linear regression by employing the equation  $y = a + bx$  for maintenance costs. The prior year's data regarding maintenance hours and costs, and the results of the regression analysis, are as follows.

Average cost per hour	\$9.00
$a$	684.65
$b$	7.2884
Standard error of $a$	49.515
Standard error of $b$	0.12126
Standard error of the estimate	34.469
$r^2$	0.99724

	<u>Hours of Activity</u>	<u>Maintenance Costs</u>
January	480	\$ 4,200
February	320	3,000
March	400	3,600
April	300	2,820
May	500	4,350
June	310	2,960
July	320	3,030
August	520	4,470
September	490	4,260
October	470	4,050
November	350	3,300
December	<u>340</u>	<u>3,160</u>
Sum	<u>4,800</u>	<u>\$43,200</u>
Average	400	\$ 3,600

Question 95: Based upon the data derived from the regression analysis, 420 maintenance hours in a month would mean the maintenance costs (rounded to the nearest dollar) would be budgeted at:

- a) \$3,780
- b) \$3,600
- c) \$3,790
- d) \$3,746

Question 96: The percentage of the total variance that can be explained by the regression equation is:

- a) 99.724%
- b) 69.613%
- c) 80.982%
- d) 99.862%

(CMA Adapted)

## Learning Curves

The term “learning curve” refers to the idea that efficiency increases the more experience a person has with a given task. As a result, the time required for performing the task decreases as increases occur in the number of times the task has been performed.

Higher costs per unit early in production are part of the start-up costs when a new activity is begun. It is commonly accepted that new products and production processes experience a period of low productivity followed by increasing productivity. However, the rate of productivity improvement declines over time until the improvement stops. The required production time reaches a level where it remains until another change in production occurs.

Learning curve analysis is used in planning, budgeting, and forecasting and also to determine estimated labor costs when bidding on a contract. A company needs to be able to estimate what the long-term costs of production will be.

Two learning-curve models are commonly used:

- 1) The **cumulative average-time learning model** is based on the assumption that the cumulative **average time required per unit** declines at a constant rate each time the cumulative quantity of units produced doubles. The cumulative average-time learning model can be used to estimate the **average** time per unit required to produce **all** of a given number of units produced.
- 2) The **incremental unit-time learning model** is based on the assumption that the incremental amount of time required to produce the **last unit** declines at a constant rate each time the cumulative quantity of units produced doubles. The incremental unit-time learning model can be used to estimate the time needed to produce the **last unit** in a quantity of units.

The learning curve will be given in a problem. The amount of the learning curve is given as a percentage, such as 70%. The percentage refers to the amount of time required as a percentage of the amount of time required at the previous level (before the most recent doubling of production). The percentage of the learning curve tells us how much improvement takes place every time production levels double. The lower the percentage, the greater the amount of learning is taking place.

The limits for learning curve percentages are as follows.

- The learning curve will always be **less than** 100%, because if the learning curve is 100% then no learning and no decrease in time required is taking place. This upper limit applies to both the cumulative average-time learning model and the incremental unit-time learning model because both assume that the time required to perform a task decreases as the task is performed multiple times.
- When the cumulative average-time learning model is being used, the learning curve percentage must be **greater than** 50%. If the learning curve percentage is less than or equal to 50%, it would mean one of two impossible scenarios exists:
  - If the learning curve is less than 50%, the total time required to produce the additional units when production doubles plus the time required to produce the initial units would be **less than** the time required for production of the initial units.
  - If the learning curve is equal to 50%, the total time required to produce the additional units when production doubles plus the time required to produce the initial units would be **equal to** the time required for production of the initial units.

Neither of the two scenarios above is possible. The additional units must require some added amount of time, so the total time for the additional units plus the time for the initial units must be greater than the time required for the initial units.

This lower limit applies to only the cumulative average-time learning model. No similar restriction exists for the incremental unit-time learning model because that model results only in an estimate of the time needed to produce just the last unit in a quantity of units. Theoretically, at least, the time required for the last unit produced could require less than 50% of the time required for the last unit before production doubled.

These limits are demonstrated below.



### 1) Cumulative Average-Time Learning Model

The cumulative average-time learning model assumes a constant rate of decline in the estimated **average time per unit** each time the quantity of units produced doubles.

For example, if the learning curve is 70%, every time the total number of units produced doubles the estimated cumulative (total) production time for **all** units produced decreases to 70% of what it would have been if no learning had taken place. We will see this effect numerically in examples below.

This model can be used to calculate three things:

- 1) The estimated **average time per unit** for the entire quantity produced, from the very first unit to the very last unit produced. This is the "cumulative average."
- 2) The estimated **total time** required for the entire quantity produced, from the very first unit to the very last unit produced.
- 3) The estimated **total production time required for a certain block of units** can be calculated by finding the total time required for all the units produced through the end of that block and subtracting from that the total time required for the units up to that block. This calculation is possible only if the block of units represents the units that are produced in a doubling of production.

For example, to calculate the total time that is required to produce units 5 through 8, calculate the total time required to produce units 1 through 8 and subtract from that the time required to produce units 1 through 4. Since the jump from 4 units to 8 units represents a doubling of production, the time requirement can be calculated for just the additional units 5 through 8.

Mathematically, two methods are used to calculate the estimated total time required for all units produced and the estimated average time required per unit for all units produced using the cumulative average model:

- 1) Calculate the estimated total time required for all units produced, then use the estimated total time to calculate the estimated cumulative average time per unit;
- 2) Calculate the estimated cumulative average time per unit, and then use the estimated average time per unit to calculate the estimated total time required for all units produced.

**Exam Tip:** The proper method to use for a particular exam problem will depend upon what the question asks and the information given, so you should learn both methods.

**Method 1: Calculate the estimated total time required for production, then use the estimated total time to calculate the estimated cumulative average time per unit:**

$$\text{Estimated total time required for all units produced} = \text{Time required for the first unit} \times (2 \times \text{LC})^n$$

Where: **LC** = Learning curve percentage (in decimal format)  
**N** = Number of doublings of units produced to date

Once the total time is known, the estimated cumulative average time per unit can be calculated by dividing the estimated total time by the total number of units produced, as follows:

$$\text{Estimated cumulative average time per unit required for all units produced} = \frac{\text{Estimated total time required for all units produced}}{\text{Total number of units produced}}$$

**Example:** A plant that manufactures cars is subject to an 80% learning curve. Ten hours are required to produce the **first** car. According to the cumulative average-time learning model, the estimated **total time** required to manufacture **the first 2** cars will be 80% of the total time it **would have taken** to produce 2 cars if no learning had taken place. The estimated total time required will be 16 hours ( $10 \times [2 \times 0.8]$ ), which equates to an estimated **cumulative average** of 8 hours for each of the first two cars ( $16 \div 2$ ). We will show this process mathematically for the first three doublings of production.

The first doubling (to produce **2 units**):

[**Note:** Any number raised by the exponent 1 is the number itself.]

- 1) Estimated **total time** required for units 1 and 2 =  $10 \times (2 \times 0.80)^1 = 10 \times 1.6 = \underline{\underline{16 \text{ hours}}}$
- 2) Estimated cumulative **average time** per unit for units 1 and 2 =  $16 \div 2 = \underline{\underline{8 \text{ hours}}}$

The second doubling (to produce **4 units**):

- 1) Estimated **total time** required for units 1 through 4 =  $10 \times (2 \times 0.80)^2 = 10 \times 2.56 = \underline{\underline{25.6 \text{ hours}}}$
- 2) Estimated cumulative **average time** per unit for units 1 through 4 =  $25.6 \div 4 = \underline{\underline{6.4 \text{ hours}}}$

The third doubling (to produce **8 units**):

- 1) Estimated **total time** required for units 1 through 8 =  $10 \times (2 \times 0.80)^3 = 10 \times 4.096 = \underline{\underline{40.96 \text{ hours}}}$
- 2) Estimated cumulative **average time** per unit for units 1 through 8 =  $40.96 \div 8 = \underline{\underline{5.12 \text{ hours}}}$

And so on.

**Method 2:** Calculate the *estimated cumulative average time per unit* for all units produced, then use the estimated cumulative average time per unit to calculate the *estimated total time* required for all units produced:

$$\text{Estimated cumulative average time per unit for all units produced} = \text{Time required for the first unit} \times \text{LC}^n$$

Where: **LC** = Learning curve percentage (in decimal format)  
**n** = Number of doublings of all units produced

This method works because the time required to produce the first unit or lot is **also** the cumulative average time required for that unit or lot. The total time required for the first unit or lot divided by the number produced (1) equals the average time per unit or lot for the first unit or lot. We are actually beginning with the **cumulative average time** per unit or lot required to produce the first unit or lot.

Once the estimated cumulative average time per unit is known, the estimated total time can be calculated by multiplying the estimated cumulative average time by the number of units produced, as follows:

$$\text{Estimated total time required for all units produced} = \text{Estimated cumulative average time per unit for all units produced} \times \text{Total number of units produced}$$

**Example:** The following doublings refer to the same plant from the previous example. It manufactures cars and is subject to an 80% learning curve. The time required to produce the first car is 10 hours.

The first doubling:

[**Note:** Any number raised by the exponent 1 is the number itself.]

- 1) Estimated cumulative **average time** per unit for units 1 and 2 =  $10 \times 0.80^1 = 10 \times 0.80 = \underline{\underline{8 \text{ hours}}}$
- 2) Estimated **total time** required for units 1 and 2 =  $8 \times 2 = \underline{\underline{16 \text{ hours}}}$

The second doubling:

- 1) Estimated cumulative **average time** per unit for units 1 through 4 =  $10 \times 0.80^2 = 10 \times 0.64 = \underline{\underline{6.4 \text{ hours}}}$
- 2) Estimated **total time** required for units 1 through 4 =  $6.4 \times 4 = \underline{\underline{25.6 \text{ hours}}}$

The third doubling:

- 1) Estimated cumulative **average time** per unit for units 1 through 8 =  $10 \times 0.80^3 = 10 \times 0.512 = \underline{\underline{5.12 \text{ hours}}}$
- 2) Estimated **total time** required for units 1 through 8 =  $5.12 \times 8 = \underline{\underline{40.96 \text{ hours}}}$

And so on.

Note that methods 1 and 2 produce identical answers. The above examples demonstrate the mathematical operation of solving the same question from different starting points.

#### Time Required for a Specific Block of Units Using the Cumulative Average Time-Learning Model

To find the estimated total time required to produce only units 5, 6, 7, and 8 in the examples above, subtract the estimated total time required for units 1 through 4 from the estimated total time required for units 1 through 8, as follows:

$$\text{Estimated total time required for units 5, 6, 7, and 8 only} = 40.96 - 25.6 = \underline{\underline{15.36 \text{ hours}}}$$

The estimated average time per unit for units 5, 6, 7, and 8 is 15.36 hours divided by 4 units, or 3.84 hours for those four units only.

To find the estimated total time required for units 3 and 4 only in the examples above, subtract the estimated total time required for units 1 and 2 from the estimated total time required for units 1 through 4, as follows:

$$\text{Estimated total time required for units 3 and 4 only} = 25.6 - 16 = \underline{\underline{9.6 \text{ hours}}}$$

The estimated average time per unit for units 3 and 4 is 9.6 hours divided by 2 units, or 4.8 hours for those two units only.

However, using this method we cannot calculate the estimated time required for just one specific unit/lot other than for unit/lot 2. Presumably within the block of units 5 through 8, unit 6 will require less time than unit 5, unit 7 will require less time than unit 6, and unit 8 will require the least time of all. We can calculate the estimated **average time** per unit for a group of units, but we have no way of calculating the estimated time for just one of the units in the group.

Either of the two methods illustrated above can be used to find either the estimated total time required for all units/lots produced or the estimated cumulative average time per unit/lot for all units/lots produced, or both, because:

- The estimated cumulative average time per unit or lot for all units/lots produced  $\times$  the total number of units or lots produced = the estimated total time for all units or lots produced; and
- The estimated total time for all units or lots produced  $\div$  the total number of units or lots produced = the estimated cumulative average time per unit or lot for all units/lots produced.

In the above examples, if no learning had taken place (LC percentage = 100%), the time required to produce 2 cars would have been 10 hours for each car, which is 20 hours (10 hours × 2).

$$10 \times (2 \times 1.00)^1 = 10 \times 2 = 20$$

A learning rate of 1.00 or 100% is equivalent to **no learning taking place**. However, because learning **did** take place, and the learning curve was 80%, the time required to produce the first car was 10 hours, and the time required to produce the second car was 6 hours, for a total of 16 hours for both. The **cumulative average time per unit** for the first two cars was 8 hours for each car.

The **maximum learning rate possible** using the cumulative average time-learning model is some percentage **greater than 50%**, for example 50.01%, or 0.5001.

The maximum learning rate must be greater than 50% because at a learning rate of exactly 50%, the total time required for production of the first 2 cars would be exactly the same as the time required to produce the first car, and that would be impossible:

$$10 \times (2 \times 0.50)^1 = 10 \times 1 = \underline{10 \text{ hours}}$$

At a rate of 49%, the total time required for production of the first two cars would be **less** than the time required to produce the first car, which would also be impossible:

$$10 \times (2 \times 0.49)^1 = 10 \times 0.98 = \underline{9.8 \text{ hours}}$$

Even 50.01% is a highly improbable rate because it would mean that the second car is estimated to require only 0.002 hours:

$$10 \times (2 \times 0.5001)^1 = 10 \times 1.0002 = \underline{10.002 \text{ hours}}$$

Thus, 50% or lower is an impossible learning rate in the cumulative average model because it is impossible to produce 2 cars in the same or less time than it took to produce the first car.

Therefore, when the cumulative average-time learning model is used, **the learning rate will always be greater than 50% and less than 100%.**

**Note:** The learning rate using the cumulative average-time learning model will always be between 50% and 100%.

Learning rates are developed by analyzing historical data. If overhead costs are applied on the basis of direct labor hours, historical overhead costs may need to be segregated according to their fixed and variable components. If so, the method used may be the high-low points method or a regression analysis. The high-low points method and the use of regression analysis to segregate fixed overhead costs from variable overhead costs are covered and illustrated in Section D of this book under the topic *Estimating Fixed and Variable Costs*.

It is highly unlikely that you would need to calculate the learning curve rate on the exam. It is very possible, though, that you will need to be able to segregate fixed costs from variable costs and be able to recognize when that technique should be applied. Segregating fixed costs from variable costs is covered in Section D under *Estimating Fixed and Variable Costs*.

**Example:** Given a 90% learning curve, the following data about productivity apply:

<u>Number of units</u>	<u>Cumulative average time per unit, in minutes</u>
100	5
200	4.5, calculated as $5 \times 0.90$
400	4.05, calculated as $4.5 \times 0.90$

Note that the cumulative average times per unit are each given for lots of 100; therefore, the total time for each line will be the cumulative average time per unit multiplied by the number of units produced.

**Question: What is the average time per unit required for the second 100 units?**

**Solution:** The first 100 units required  $100 \times 5 = 500$  minutes to produce. The first 200 units (units 1 through 200) required  $200 \times 4.5 = 900$  minutes to produce.

Therefore, the average time per unit required for the second 100 units (units 101 through 200) is  $(900 \text{ minutes} - 500 \text{ minutes}) \div 100 \text{ units} = \underline{4 \text{ minutes}}$ .

**Example:** The cost accountant for Ray Lighting Manufacturing Company is planning production costs for a new lamp. Production of the new lamp will be subject to a 60% learning curve since it involves only minimal adjustments to established processes. The initial lot of 500 lamps is expected to require 1,000 hours of labor. Costs are as follows:

Direct Labor	\$20/hr.
Direct Materials	\$150/lot of 500
Variable OH Applied	\$25/DLH

**(1) Question: What is the estimated cumulative average time per unit after 8 lots have been manufactured, if the cumulative average-time learning model is used?**

**Answer:** When the learning curve is 60% and the quantity of units produced doubles, the estimated cumulative average time per unit for the doubled number of units is 60% of the cumulative average time per unit for the original number of units.

In this case, we are working with lots of 500 rather than units. However, the question asks for average time **per unit**.

The **first doubling** will occur when the **second lot** of 500 has been produced. The **second doubling** will occur when the **fourth lot** of 500 has been produced. The **third doubling** will occur when the **eighth lot** of 500 has been produced. Therefore, we need to calculate three doublings of production, which means that in our formula  $n = 3$ , and  $LC = 0.60$ .

The estimated **total** number of labor hours required for 8 lots of 500 lamps is:

$$1,000 \times (2 \times 0.60)^3 =$$

$$1,000 \times 1.2^3 = \underline{1,728 \text{ estimated total labor hours}} \text{ required for 8 lots.}$$

We can find the estimated cumulative average number of labor hours required **per lamp** for 8 lots of 500 lamps each by dividing this total of 1,728 labor hours required for 8 lots by the total number of lamps produced in 8 lots, which is  $500 \times 8$ , or 4,000:

$$1,728 \text{ hours} \div 4,000 = \underline{0.432} \text{ estimated cumulative average number of labor hours required per lamp for 8 lots of 500 lamps each.}$$

Alternatively, we can calculate the estimated cumulative average number of labor hours required **per lot** for 8 lots and use that to determine the average number of labor hours **per unit** for 8 lots.

$$1,000 \times 0.60^3 = 216 \text{ estimated cumulative average number of labor hours per lot for 8 lots.}$$

$$216 \text{ estimated cumulative average labor hours per lot} \div 500 \text{ lamps per lot} = 0.432 \text{ estimated cumulative average number of labor hours required per lamp for 8 lots of 500 lamps each.}$$

(Continued)

**(2) Question: What is the estimated incremental variable cost for the eighth lot using the cumulative average-time learning model?**

**Answer:**

Estimated total number of hours required to produce 8 lots =  $1,000 \times (2 \times 0.60)^3 = 1,728$  hours

Estimated total number of hours required to produce 4 lots =  $1,000 \times (2 \times 0.60)^2 = 1,440$  hours

Estimated total number of hours required to produce lots 5-8: 1,728 hours – 1,440 hours = 288 hours

**Estimated average number of hours per lot for lots 5-8:  $288 \div 4 = 72$**

The total variable cost per direct labor hour is \$45. Since an estimated 72 hours are required to produce the eighth lot, the estimated variable cost of the eighth lot is \$3,240 [ $72 \times (\$20 + \$25)$ ].

Direct materials cost for 1 lot of 500 units: \$150

**Estimated incremental variable cost for the eighth lot =  $\$3,240 + \$150 = \$3,390$**

Note that this is the incremental cost for lots 5, 6, and 7 as well. The incremental cost per lot is the **average** incremental cost per lot for those four lots (5, 6, 7, and 8).

## 2) Incremental Unit-Time Learning Model

The incremental unit-time learning model states that the estimated **time needed to produce the last unit** (incremental unit time) declines at a constant rate each time the cumulative quantity of units produced doubles.

This model can be used to calculate **the estimated time required to produce one specific unit** after the first unit, given the time required to produce the first unit.

A financial calculator or a computer is required to calculate the estimated amount of time required for each specific unit. The estimated time can be calculated without a financial calculator or a computer for only the **last** unit of each doubling in total units produced. For example, the time required to produce unit 2 (the last unit of the first doubling), unit 4 (the last unit of the second doubling), unit 8 (the last unit of the third doubling), and so forth can be calculated. The estimated times required to produce units 3, 5, 6, and 7 cannot be calculated without the assistance of a financial calculator or a computer.

The incremental unit-time learning model can be used to calculate the estimated total time required to produce a given number of units or the estimated average time per unit **only** if the estimated time for **each** individual unit can be calculated. The estimated time for each individual unit can be calculated only with a financial calculator or a computer. The estimated total time will be the sum of all the calculated estimated individual unit times, and the estimated average time per unit will be the estimated total time divided by the total number of units produced.

The calculation of the estimated time required **for the last unit** of each doubling **without a financial calculator** using the incremental unit-time learning model is done in exactly the same manner as the calculation of the estimated cumulative average time per unit for all units produced under the cumulative average-time learning model. In other words, the same number results from both calculations. However, **the results are interpreted very differently.**

- Under the incremental unit-time learning model, the figure that results from the calculation is the **estimated time required to produce the last unit** produced each time production doubles.
- Under the cumulative average-time learning model, the figure that results from the calculation is the **estimated cumulative average time per unit for all units produced.**

The formula for calculating the estimated time required to produce the last unit of each production doubling under the incremental unit-time learning model is:

$$\begin{array}{l} \text{Estimated time required to produce the} \\ \text{last unit produced each time} \\ \text{production doubles} \end{array} = \text{Time required for the first unit} \times \text{LC}^n$$

Where: **LC** = Learning curve percentage (in decimal format)  
**n** = Number of doublings of production for all units produced

**Example:** The following refers to the same car manufacturing plant mentioned previously, which is subject to an 80% learning curve rate and requires 10 hours to build the **first** car.

If the incremental unit-time learning model is used, the estimated time required to manufacture the **second** car will be 80% of 10 hours, or 8 hours. Thus, the estimated total time required to produce two cars is 10 hours + 8 hours, or 18 hours. The estimated **average time** per unit produced will be  $18 \div 2$ , or 9 hours.

However, the last unit produced in the first doubling (the second unit) is the only instance where the estimated average time per unit produced can be determined under the incremental model without a financial calculator. Above the level of 2 units (the first doubling), the estimated total time to produce all the units cannot be calculated using the formula above; thus, the estimated average time per unit also cannot be calculated.

The **first doubling**:

Estimated time required to produce **unit 2** (only unit 2) =  $10 \times 0.80^1 = 10 \times 0.80 = 8 \text{ hours}$

The **second doubling**:

Estimated time required to produce **unit 4** (only unit 4) =  $10 \times 0.80^2 = 10 \times 0.64 = 6.4 \text{ hours}$

The **third doubling**:

Estimated time required to produce **unit 8** (only unit 8) =  $10 \times 0.80^3 = 10 \times 0.512 = 5.12 \text{ hours}$

These are the same numbers that were calculated using the cumulative average time-learning model when we were calculating the cumulative average time per unit, beginning with the time for the first unit. Under the cumulative average-time learning model, however, the result is interpreted as the estimated **average time per unit for all units produced**.

When the incremental unit-time learning model is used, however, the same result is interpreted as an estimate of the **time required to produce the last unit only**. Every unit produced prior to that last unit will require more production time than the last unit, since learning curves result in a reduction of time as more units are produced. Thus, the total estimated time for all units and the average estimated time per unit must be greater under the incremental model than under the cumulative average model.

**Example:** Assume that production of the first unit requires 12 hours and that the learning curve is 80%. To determine the estimated production time for the 2nd unit under the incremental model, we multiply 12 by  $0.80^1$ , which equals 9.6 hours. The estimated time required to produce unit 4 (the last unit of the second doubling) is  $12 \times 0.80^2$ , which equals 7.68 hours. The estimated time for unit 8 (the last unit of the third doubling) is  $12 \times 0.80^3$ , which is 6.144 hours, and so on for units 16, 32, and further doublings of production.

Note that these calculated times are for **only** units 2, 4, 8, 16, and so forth as this method calculates only the estimated time to produce the **last** unit each time that production doubles. This method cannot determine how much time will be required to produce units 3, 5, 6, 7, and so forth.

Here is the Ray Lighting Manufacturing example once again, this time using the incremental unit-time learning model to calculate the items that can be calculated without a financial calculator.

**Example:** The cost accountant for Ray Lighting Manufacturing Company is planning production costs for a new lamp. The lamp will be subject to a 60% learning curve since it involves only minimal adjustments to established processes. The accountant expects the initial lot of 500 lamps to require 1,000 hours of labor. Costs are as follows:

Direct Labor	\$20/hr.
Direct Materials	\$150/lot of 500
Variable OH Applied	\$25/DLH

**(1) Question: What is the time required to produce the eighth lot, using the incremental unit-time learning model?**

**Answer:** Under the incremental unit-time learning model, the estimated time needed to produce the last unit declines at a constant rate each time the cumulative quantity of units produced doubles. With a 60% learning curve, each time the total quantity of units produced doubles the time required to produce the last unit is estimated to be 60% of the time that was required to produce the last unit of the previous production doubling point.

In this case, we are working with lots of 500 rather than units, so the eighth lot is the last unit of that doubling level. Therefore, the time required to produce the eighth lot of 500 is:

$$1,000 \times 0.60^3 = \underline{216 \text{ hours.}}$$

It is not possible to use the incremental unit-time learning model to determine the estimated total number of hours required to produce the entire 8 lots without a financial calculator. To calculate the estimated time required for lots 3, 5, 6, and 7 requires a financial calculator.

**(2) Question: What is the estimated incremental variable cost for the eighth lot using the incremental unit-time learning model?**

**Answer:** To determine the estimated cost of the eighth lot under the incremental unit-time learning model, take the 216 hours required for the eighth lot (calculated above), multiply it by the \$45 total variable cost per hour for direct labor and variable overhead, and add the \$150 cost per lot for direct materials. The incremental variable cost for the eighth lot is  $(216 \times \$45) + \$150 = \underline{\$9,870}$ .

Note that this is the incremental variable cost for **only the eighth lot** of 500 lamps. We have not calculated the estimated total cost for the entire 8 lots since we would need either a financial calculator or a computer to do so.



### Using a Financial Calculator with the Incremental Unit-Time Learning Model

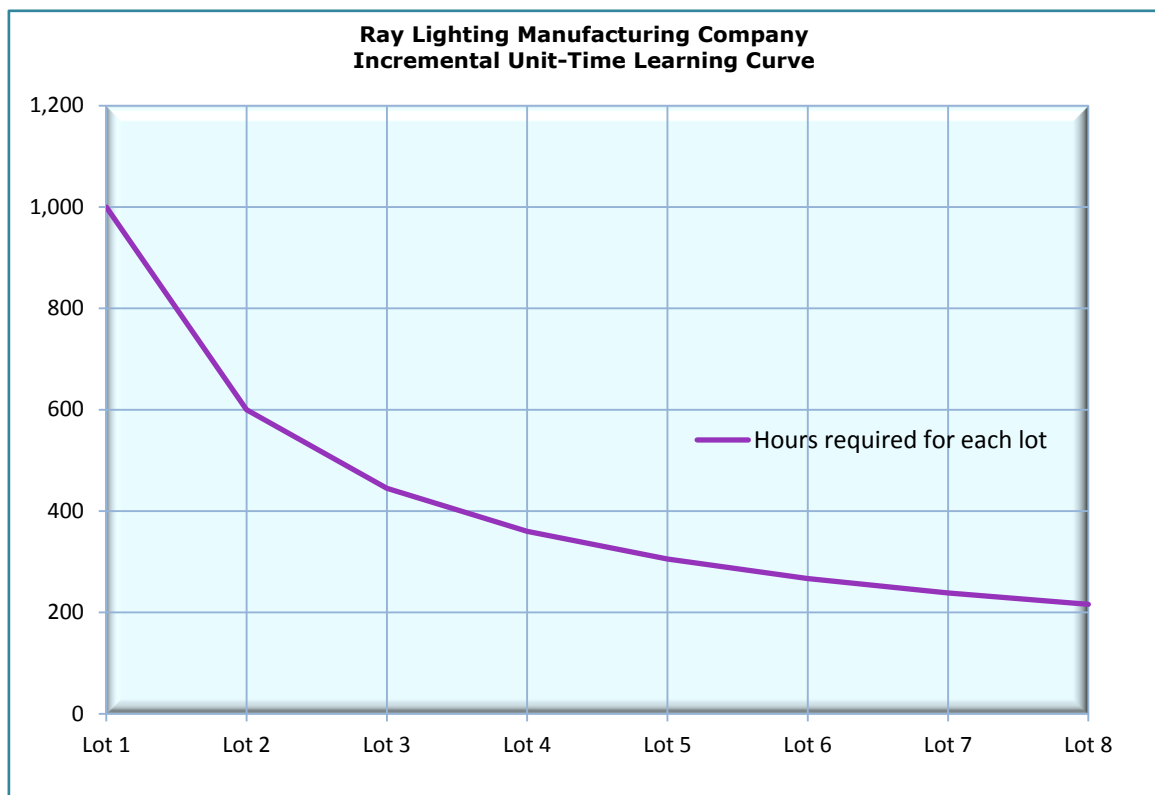
Four financial calculators are allowed on the CMA exams, though they are not required. The four permitted models are:

- 1) Texas Instruments BA II Plus (**not** the BA II Plus Professional).
- 2) Hewlett Packard 10BII.
- 3) Hewlett Packard 12c.
- 4) Hewlett Packard 12c Platinum.

Since a financial calculator is not required on the exam, we do not expect that you will need to know how to calculate the time required to produce units other than the last unit of each group of doubled units under the incremental model. For candidates who are interested in learning how to calculate the time required for every unit, however, the time required for each of the 8 lots for the Ray Lighting Manufacturing example above is explained and calculated in **Appendix A** using the incremental unit-time learning model and a financial calculator.

### Learning Curves as Nonlinear Cost Functions

Below is a graphical representation of the Ray Lighting learning curve showing the times calculated for each lot in Appendix A using the incremental unit-time learning curve and a financial calculator. A learning curve is an example of a **nonlinear cost function**. A nonlinear cost function graphs as a curved line.



## Answering Learning Curve Questions on the CMA Exam

An exam question may ask for the estimated time or cost without indicating which learning curve model to use.

- If the question asks for the estimated time required for the **final** unit in a production process where production levels are doubling, try the incremental model first. On the multiple-choice portion of the exam, see if the answer calculated under the incremental model results in one of the answer choices. If it does not, then try working the problem using the cumulative average model.
- If an exam question asks for the **total time** or the **average** time per unit, use the cumulative average model.
- If the question is in the essay section, look carefully at what the question is asking for. If it asks for total time or average time per unit, use the cumulative average model. If it asks for the time required for the last unit only, use the incremental model. In your answer, identify which model you used.

## Summary of and Observations About the Two Models

All things being equal, the **incremental unit-time learning model will predict a higher cumulative total time** (and thus a higher average time per unit) to produce two or more units than the cumulative average-time learning model.

- The cumulative average-time learning model indicates that the estimated total time required for Ray Lighting to produce 8 lots is 1,728 hours, and the estimated average time per lot is 216 hours ( $1,728 \div 8$ ).
- The incremental unit-time learning model indicates that the estimated total time required for Ray Lighting to produce 8 lots is 3,432 hours, nearly twice as long as the cumulative average model, and the estimated average time per lot is 429 hours ( $3,432 \div 8$ ). (As noted above, the estimated total number of hours required was calculated using a financial calculator and is presented in Appendix A).

In a real-life situation, the choice of which learning curves model to use should be based on which one more accurately predicts the behavior of labor hour usage as production levels increase.

The estimated **average** time per unit or lot as calculated using the cumulative average-time learning model will be the same as the estimated time required for the **last** unit or lot as calculated using the incremental unit-time learning model.

- The estimated **average** time per lot for 8 lots for Ray Lighting using the cumulative average-time learning model is **216** hours.
- Using the incremental unit-time learning model, the estimated time required for only the **eighth lot** is also **216** hours.

## Benefits of Learning Curve Analysis

The following are some examples of decisions that can be aided by learning curve analysis:

- Development of production plans and labor requirements: Learning curves should be used in the development of production and labor budgets when changes such as new products are planned.
- Management control: Recognizing that higher costs will occur in the early phase of the product life cycle allows more effective evaluation of managers.
- Development of standard costs: Labor costs should be adjusted regularly in recognition of the fact that learning causes standard costs to decrease over time.
- Life-Cycle costing: In calculating the cost of a contract, learning curve analysis can ensure that the cost estimates are accurate over the life of the contract, leading to better bidding.
- Cost-Volume-Profit analysis: If learning is not considered in determining a breakeven point, the result may be an overstatement of the number of units required to break even. (Cost-Volume-Profit analysis and breakeven point calculation are covered on the CMA Part 2 exam.)
- Capital budgeting: Costs can be projected more accurately over the life of the capital investment when expected improvements in labor productivity due to learning are included. (Capital Budgeting is covered on the CMA Part 2 exam.)
- Make or buy decisions: The analysis of the cost to make the product will be affected by the learning curve in effect. (Make or buy decisions are covered on the CMA Part 2 exam.)

## Limitations of Learning Curve Analysis

Limitations and problems associated with learning curve analysis include:

- Learning curve analysis is **appropriate only for labor-intensive operations involving repetitive tasks** where repeated trials improve performance. If the production process primarily relies on robotics and computer controls, little repetitive labor is involved and thus little opportunity exists for learning to take place.
- The **learning rate is assumed to be constant**. In real life, the decline in labor time might not be constant. For example, the time required might decline at the rate of 70% for the first 75,000 units, followed by 80% for the next 50,000 units, and 95% for the next 25,000 units.
- The reliability of a learning curve calculation can be jeopardized because **an observed change in productivity might actually be associated with factors other than learning**, such as a change in the labor mix, the product mix, or other factors. If some factor or factors other than learning are affecting productivity, a learning model developed using the affected historical data will produce inaccurate estimates of labor time and cost.

Question 97: The average labor cost per unit for the first batch produced by a new process is \$120. The cumulative average labor cost after the second batch is \$72 per product. Using a batch size of 100 and assuming the learning curve continues, the total labor cost of four batches will be:

- a) \$4,320
- b) \$10,368
- c) \$2,592
- d) \$17,280

(CMA Adapted)

**The following information is for the next two questions:** Moss Point Manufacturing recently completed and sold an order of 50 units that had costs as follows.

Direct materials	\$ 1,500
Direct labor (1,000 hours x 8.50)	8,500
Variable overhead (1,000 hours x \$4.00)*	4,000
Fixed overhead**	<u>1,400</u>
	<u>\$15,400</u>

\*Applied on the basis of direct labor hours.

\*\*Applied at the rate of 10% of variable cost.

The company has now been requested to prepare a bid for 150 units of the same product.

Question 98: If an 80 percent learning curve is applicable, Moss Point's total cost on this order would be estimated at:

- a) \$26,400
- b) \$31,790
- c) \$37,950
- d) \$38,500

Question 99: If Moss Point experienced a 70 percent learning curve, the bid for 150 units would:

- a) Show a 30 percent reduction in the total direct labor hours required with no learning curve.
- b) Include increased fixed overhead costs.
- c) Be 10 percent lower than the total bid at an 80 percent learning curve.
- d) Include 6.40 direct labor hours per unit at \$8.50 per hour.

(CMA Adapted)

Question 100: Reeves Inc. has developed a new production process to manufacture its product. The new process is complex and requires a high degree of technical skill. However, management believes there is a good opportunity for the employees to improve as they become more familiar with the production process. The production of the first unit requires 100 direct labor hours. If a 70% learning curve is used, the cumulative direct labor hours required to produce a total of eight units would be

- a) 196 hours
- b) 274 hours
- c) 392 hours
- d) 560 hours

(ICMA 2010)

## Probability

There are many events in business and nature for which it is impossible to exactly predict the outcome. However, the probability of the occurrence of an event can be described quantitatively (that is, numerically) if the same event occurs a great number of times under finite conditions. For example, it is impossible to predict with 100% certainty whether a fairly-tossed coin will turn up heads or tails in one particular toss. But if we toss that coin many times, we can conclude that the frequency of times heads appears will be very close to 50%.

Probability gives us a numerical measurement of the likelihood that an event will occur. Probability is used in forecasting and budgeting to create an **expected value** for an element that needs to be forecasted (such as future cash flows). The expected value is used in the budget. ("Expected value" will be defined and discussed shortly.)

Probability is always expressed as a value between 0 and 1, and this expression is usually converted to a percentage between 0 and 100. The closer the probability is to 0 the less likely the event will occur. A probability of 0 (or 0%) means there is no chance that the event will occur. Conversely, a probability near 1 tells us that the event is almost certain to occur, and a probability of exactly 1 (or 100%) would mean the event is absolutely certain to occur. Probabilities between 0 and 1 give a range of probabilities that an event will occur. For example, when the probability of rain today is 40%, we might decide to carry an umbrella, whereas when the probability of rain is only 20%, we might leave the umbrella at home.

### Two Requirements of Probability

When the weather forecaster says there is a 40% probability that it will rain today, it also implicitly means there is a 60% probability that it **will not** rain. This illustrates the **two basic requirements of probability**:

- 1) The probability values assigned to **each** of the possible outcomes must be between 0 and 1; **and**
- 2) The probable values assigned to **all** of the possible outcomes must total 1.

## Probabilities of Independent Events and Mutually Exclusive Events

### Independent Events

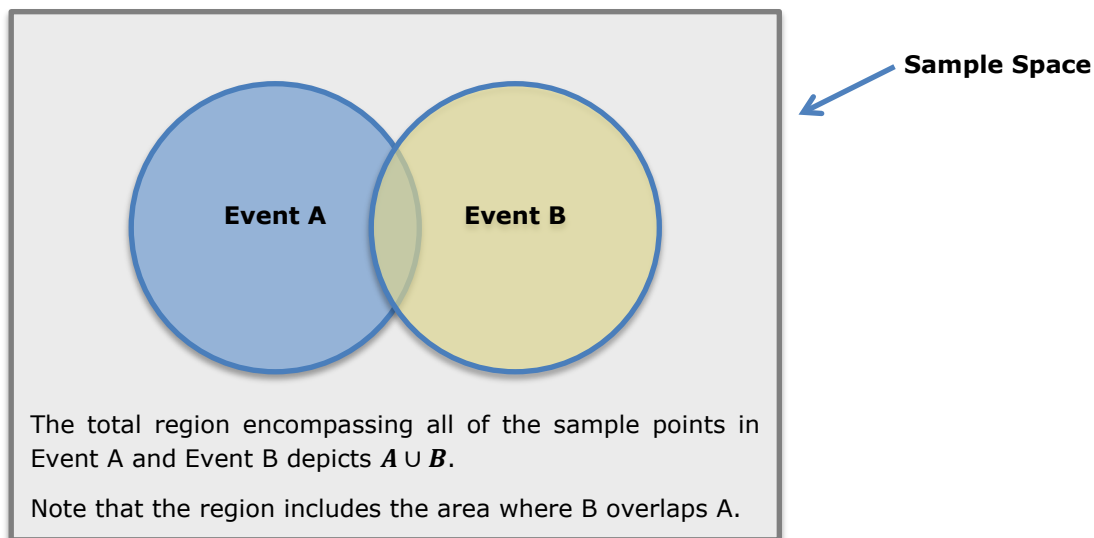
If the occurrence or nonoccurrence of one event does not change the probability of the occurrence of the other event, the two events are said to be **independent**.

The **addition law** can be used when there are two possible events and we want to know the probability that **at least one** of the events will occur. In other words, for events A and B, we want to know the probability that event A **or** event B **or** both events will occur.

Events that are independent and not mutually exclusive can have sample points in common. That is, in some cases **both** A and B can occur. We need to include those cases in our calculation of the probability that at least one of the events will occur; but we do not want to double count them because of counting them once with A's probability and again with B's probability.

The **union of events A and B** is the event containing all the sample points belonging to A **or** B **or** both. It represents the probability that either A or B will occur, including the probability that both will occur.

The union of events A and B is denoted as  $A \cup B$ . The diagram below, called a **Venn diagram**, illustrates the union of events A and B:

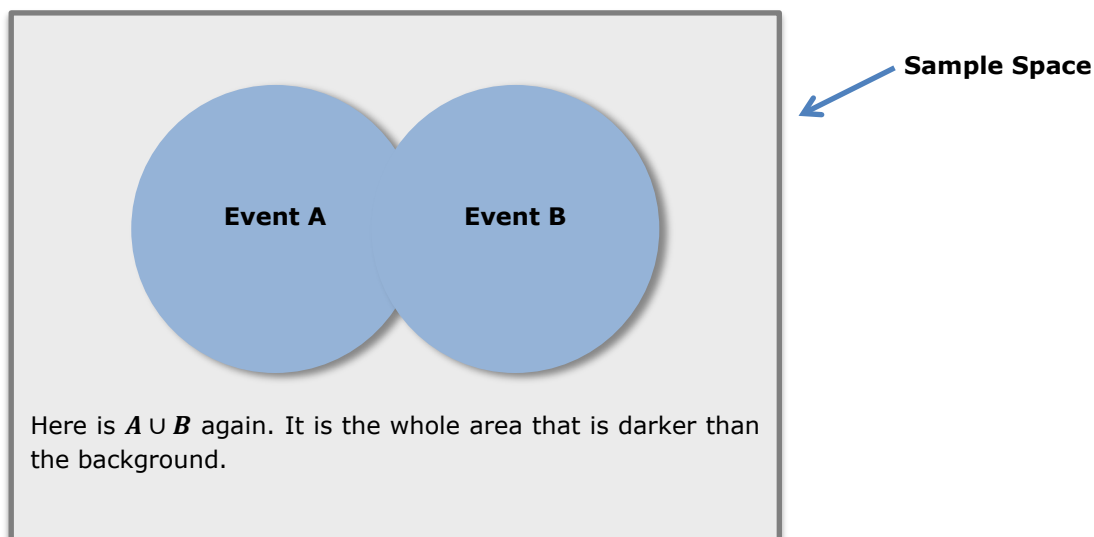


In the preceding Venn diagram, the fact that the circles overlap means that some sample points are in both A and B. The **intersection of events A and B** is the place where the circles overlap because it contains the sample points belonging to **both A and B**. The **intersection** of A and B is denoted by  $A \cap B$ .  $A \cap B$  is the event that both events occur. The probability of  $A \cap B$  occurring is called **joint probability**.

Therefore, the probability of Event A **or** Event B **or** both A and B occurring is the total area of A **plus** B ( $A \cup B$ ) **minus** the area ( $A \cap B$ ) where B overlaps A (their joint probability). We subtract  $A \cap B$  so that the area of overlap is not double counted.

The probability of Event A **or** Event B **or** Both A and B occurring is thus calculated as follows:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$



### Calculating the Joint Probability of Two Independent Events

The area of the overlap—the **joint probability**—is the probability that both events will occur. That area qualifies to be included in the probability that either one of the events will occur, because one of the events certainly occurs in the area of the overlap. But we want to include it once, not twice, so we subtract it from the sum of the two events' probabilities, as we did in the formula above. To subtract it, though, we need to know what it is.

How can we calculate the joint probability of **both** A and B occurring? In other words, how can we calculate the probability in the area of the overlap, or  $A \cap B$ ?

The probability of  $A \cap B$ , or the area of the overlap, is calculated as follows:

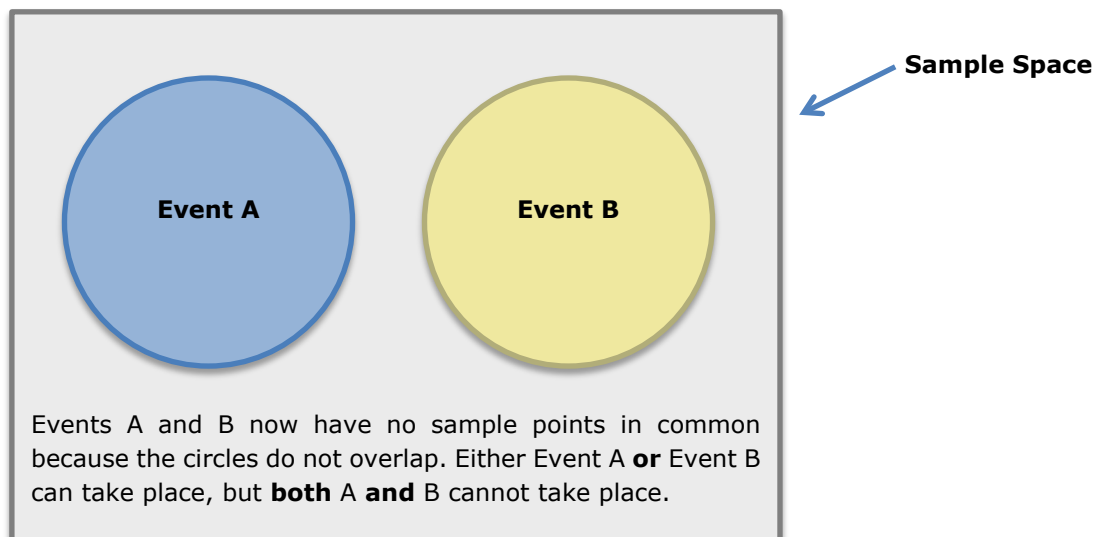
$$A \cap B = P(A) \times P(B)$$

For example, if the probability of Event A occurring is 20% and the probability of Event B occurring is 25% and they are independent and not mutually exclusive events, the probability of **both** A and B occurring is  $0.20 \times 0.25$ , or 0.05 or 5%.

### Mutually Exclusive Events

If events are mutually exclusive, it means that if one of them occurs, the other event cannot occur. Either one or the other can occur but not both.

Mutually exclusive events are pictured on a Venn diagram as follows:



For mutually exclusive events, we still use the term **union** to denote the event containing all the sample points belonging to A or B the same as we did for independent events, and we still use the addition law though we make an adjustment to the law.

The event containing all the sample points belonging to A or B is called the **union of events A and B** the same as it was when the events were not mutually exclusive. But because the circles cannot overlap, the union of events A and B (or the probability of Event A or Event B occurring) is calculated differently from the way it was calculated when the circles overlapped.

In the special case of mutually exclusive events, the addition law becomes

$$P(A \cup B) = P(A) + P(B)$$

That makes sense, because the probability of both events' occurring ( $A \cap B$ ) is zero, since both events cannot occur. Theoretically, we could use the same addition rule as we used when the events were not mutually

exclusive (when there was an area of overlap), but there would be no point in doing so. We would be subtracting zero.

### Examples of Independent Events and Mutually Exclusive Events

**Examples** of the addition law of probability used for independent events and mutually exclusive events:

In its sales forecasting, an appliance retailer develops a set of probabilities for sales in each of its product lines for the coming year. Sales forecasts for two of these product lines are as follows:

**Refrigerators:** There is a 30% probability that sales of refrigerators will be \$5,000,000; a 50% probability that sales will be \$7,500,000; and a 20% probability that sales will be \$10,000,000.

**Electric Ranges:** There is a 25% probability that sales of electric ranges will be \$2,000,000; a 55% probability that sales will be \$3,000,000; and a 20% probability that sales will be \$5,000,000.

The forecasts for these appliances relate to sales for the following year. Therefore, the actual events (sales of refrigerators and ranges) will both be occurring at the same time. The forecast for sales of refrigerators is not dependent on sales of electric ranges occurring, and the forecast for sales of electric ranges is not dependent on sales of refrigerators occurring. Thus sales of refrigerators and sales of ranges are independent of each other.

What is the probability that sales of refrigerators will be \$7,500,000 **or** sales of electric ranges will be \$3,000,000 next year? According to the above information:

- The probability that sales of refrigerators will be \$7,500,000 next year is 50%.
- The probability that sales of electric ranges will be \$3,000,000 next year is 55%.
- The probability that sales of refrigerators will be \$7,500,000 **and** that sales of electric ranges will be \$3,000,000 is  $0.50 \times 0.55$ , which equals 0.275 or 27.5%.

Therefore, the probability that sales of refrigerators will be \$7,500,000 **or** sales of electric ranges will be \$3,000,000 next year **or** that both events will occur next year is

$$0.50 + 0.55 - 0.275 = 0.775 \text{ or } 77.5\%$$

In the example above, refrigerator sales of \$7,500,000 and electric range sales of \$3,000,000 are not mutually exclusive. In other words, it is possible for refrigerator sales to be \$7,500,000 **and** for electric range sales to be \$3,000,000. In fact, we calculated the probability of that occurring as 27.5%.

What if instead the retailer wanted to know the probability of refrigerator sales being **either** \$5,000,000 **or** \$7,500,000? That makes our probability question one of mutually exclusive events. Refrigerator sales cannot be \$5,000,000 **and** \$7,500,000 at the same time.

- The probability that sales of refrigerators will be \$5,000,000 next year is 30%.
- The probability that sales of refrigerators will be \$7,500,000 next year is 50%.

Therefore, the probability that sales of refrigerators will be \$5,000,000 **or** \$7,500,000 next year is

$$0.30 + 0.50 = 0.80 \text{ or } 80\%$$

**Note:** Independent events and mutually exclusive events are very different.

- Two events A and B are **independent** if the occurrence or non-occurrence of one event does not change the probability of the occurrence of the other event.
- Two events A and B are **mutually exclusive** if only one of them can occur, that is, when one of them occurs, the other event cannot occur.



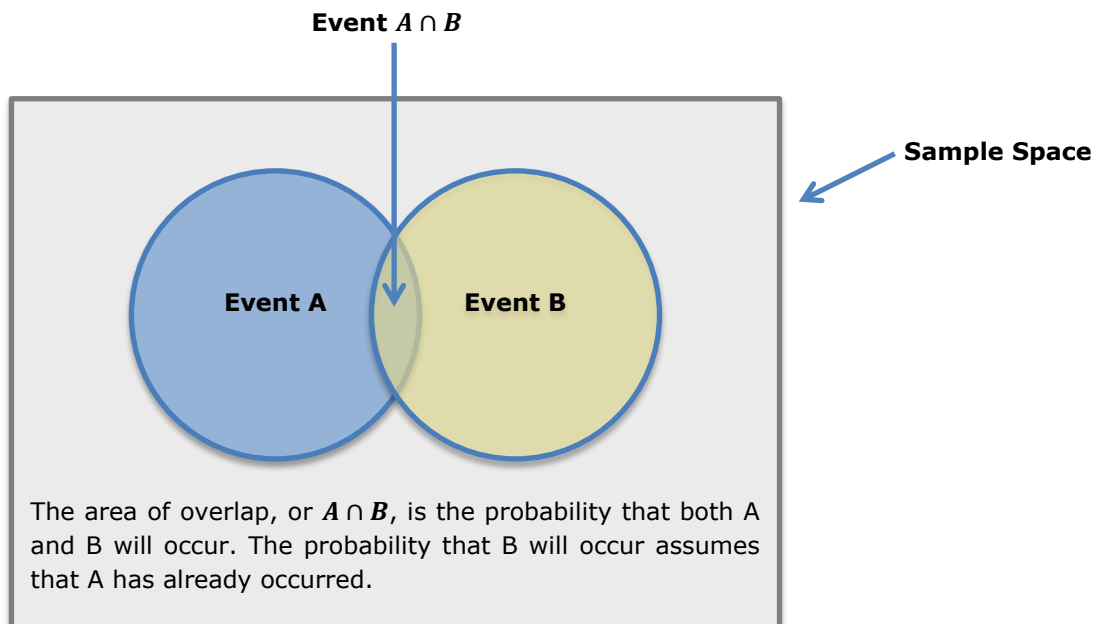
## Dependent Events and Conditional Probability

When there are two events, A and B, and the occurrence of B depends upon the occurrence of A, the probability that both events will occur is the probability that the first event will occur, multiplied by the **conditional probability** that the second event will occur **given that the first event has already occurred**.

In our Venn diagram, the probability that both events will occur is the area of the overlap, or  $A \cap B$ . The probability of both events occurring is written as follows.

$$P(A \cap B) = P(A) \times P(B|A)$$

The expression  $P(B|A)$  means "the probability of B given A." We are saying "If A occurs, the probability of B occurring after A has occurred is X%."



If the **conditional probability** of B given that A has occurred is not known but the probability of A and the probability of both A and then B occurring is known, the conditional probability of B given that A has occurred can be derived from the original formula by dividing both sides of the formula by the probability of A:

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

**Example:** In planning a new product, we develop expected sales for Year 1 based on the probabilities of various forecasted sales amounts. It is determined that there is a 30% probability that the product will be highly successful and sales will be \$1,000,000; a 40% probability that the product will be moderately successful and sales will be \$700,000; and a 30% probability that the product will not be successful and sales will be only \$200,000.

We might then develop sales forecast probabilities for Year 2 that **depend upon** what happens in Year 1. For instance, **if** the product is highly successful and sales are \$1,000,000 in Year 1, we may determine that there is a 40% probability that sales in Year 2 will be \$1,500,000; a 40% probability that sales will remain even at \$1,000,000 in Year 2; and a 20% probability that sales will go down to \$750,000 in Year 2.

We would, of course, develop different sets of probabilities for Year 2 in the event that either of the other possible Year 1 sales (\$700,000 or \$200,000) were to occur.

In this example, the probabilities for Year 2 sales are the **conditional** probabilities. They **depend upon** sales in Year 1 being \$1,000,000. If sales in Year 1 are \$700,000 or \$200,000, then different conditional probabilities will apply to Year 2 sales.

Using this set of probabilities, what is the probability of sales being \$1,000,000 in Year 1 **and then** \$1,500,000 in Year 2?

The probability of sales being \$1,500,000 in Year 2 (**if** they were \$1,000,000 in Year 1) is, as has been stated above, 40%. 40% is the **conditional probability** that sales will be \$1,500,000 in Year 2, given that they are \$1,000,000 in Year 1.

The probability of sales being \$1,000,000 in Year 1 **and** of sales being \$1,500,000 in Year 2 is calculated the same way joint probability is calculated for two independent events, because we are calculating the same thing: the area of overlap, or  $A \cap B$ . The difference is that joint probability applies to independent events that occur at the same time, whereas conditional probability deals with dependent events that occur sequentially.

Thus, the probability of sales being \$1,000,000 in Year 1 **and** \$1,500,000 in Year 2 is the probability of sales being \$1,000,000 in Year 1 **multiplied by** the conditional probability that sales will be \$1,500,000 in Year 2, or:

$$0.30 \times 0.40 = 0.12 \text{ or } 12\%$$

Furthermore, this 12% figure assists us in calculating the conditional probability of sales being \$1,500,000 in Year 2 if sales in Year 1 are \$1,000,000. Divide 12% by 30% (i.e., by the probability of sales in Year 1 being \$1,000,000):

$$\text{Conditional probability} = 0.12 \div 0.30 = 0.40 \text{ or } 40\%$$

Summary of Rules of Probability	
Item	Calculation
Probability of <b>one or both</b> of two independent events occurring	The sum of their individual probabilities minus their joint probability.
<b>Joint</b> probability of two independent events occurring (the probability that both events will occur)	The probability of the first event multiplied by the probability of the second event.
Probability of <b>either one</b> of two mutually exclusive events occurring	The probability of the first event plus the probability of the second event.
<b>Conditional</b> probability, the probability of a second event occurring given that a first event has already occurred.	<p>The probability of both events occurring is the probability of the first event multiplied by the conditional probability of the second event given the first event has already occurred.</p> <p>The conditional probability of the second event given that the first event has occurred is the probability of both events occurring divided by the probability of the first event.</p>

### Three Methods of Assigning Probable Values

Three methods are used to assign probable values to possible outcomes: the **Classical Method**, the **Relative Frequency Method**, and the **Subjective Method**.

- 1) **Classical Method:** This method assumes that each possible outcome has an equal probability of occurring. Thus, if there are ten possible outcomes, each outcome is assumed to have a 10% probability of occurring. This is the method used to assign probabilities to coin tosses or dice rolls. Business decisions don't usually involve coin tosses or dice rolls, so the **classical method** is seldom used in situations of business uncertainty.
- 2) **Relative Frequency or Objective Method:** When factual information is available that can be used to determine the probability of something occurring, the use of that information to assign probabilities is called the **relative frequency method**. The information may come from a sample, analytical data, or any other reliable source.
- 3) **Subjective Method:** This method is used when neither the classical nor the relative frequency methods can be used because the possible outcomes are not equally likely and relative frequency data is not available. With the **subjective method** of assigning probabilities, we use whatever data is available and add to that data our own experience and intuition. After considering all available information, we assign a probable value that expresses our **degree of belief** that the outcome will occur. Subjective probability is personally determined, and different people will assign different probabilities to the same event. Despite this relative freedom in assigning probabilities, the two necessary requirements for all probabilities must nevertheless be met:
  - a. The probable value for each possible outcome must be between 0 and 1; and
  - b. All the probabilities for all the possible outcomes must total 1.

Sometimes the various methods are used in combination, such as when probabilities are determined by combining estimates from the classical or relative frequency methods with subjective probability estimates.

## Discrete and Continuous Random Variables

The formal definition of **random variable** is “a numerical description of the outcome of an experiment.” A random variable is a variable that can have any value within a range of values that occurs randomly and can be described using probabilities.

For example, we might need to analyze the number of items sold in one day. If  $x$  equals the number of items sold in one day,  $x$  is the **random variable**. We do not know the exact value of the random variable for a given day until we have observed sales for that day. On one day, observed sales might be 1,500 items; on the next day it might be 1,725 items; on the next day, only 1,350, and so on.

If the random variable can take on any one of a number of values that can be counted, and if those values are always whole numbers (such as number of items sold), the random variable is called a **discrete random variable**. For example, the number of customers coming into a store between the hours of 12 noon and 1 p.m. is a discrete random variable. The number of people can be counted. Since a fraction of a person cannot come into the store, the overall person count will be a whole number like 50, 51, 52, or 53. The number can be as little as 1 or as large as several thousand, but it must be a whole number that can be counted.

In some cases, a random variable can take on any value whatsoever within an interval or a collection of intervals. If a random variable can take on any value whatsoever in the interval from 0 to 100 (for example, 5.635 or 72.36092), the random variable is a **continuous random variable**. Since the number of decimal places the continuous random variable can have is unlimited, there can be no limit to the number of different values the variable could assume. Any measurement with a set of values that form points on a line with no interruption or intervening spaces between the points is a continuous random variable.

To determine whether a random variable is discrete or continuous, choose two points representing values that the variable could take and illustrate them as points on a graph. If the line segment connecting the two points **also** represents all the possible values between the two points for the random variable, then the random variable is continuous. If the line segment between the two points **does not** represent all possible values between the two points for the random variable (such as half a person, which is an impossibility), then the random variable is discrete.

## Discrete Random Variable Probability Distributions

The formal definition of **probability distribution** is “a table or an equation that links each outcome of a statistical experiment with its probability of occurring.” We can develop a **probability distribution** for a discrete random variable by observing historical data.

**Example:** We have a computer store and we need to know how many computers are sold each day in order to make sure our inventory levels are sufficient. We group together the number of computers sold each day to show how many days in a year we had no sales at all, how many days we had one sale, and so on. The maximum number of computers we have sold in any one day is 10. Our store is open 6 days per week, or 312 days per year. We set up the following table with observed data. This is called a **frequency distribution**:

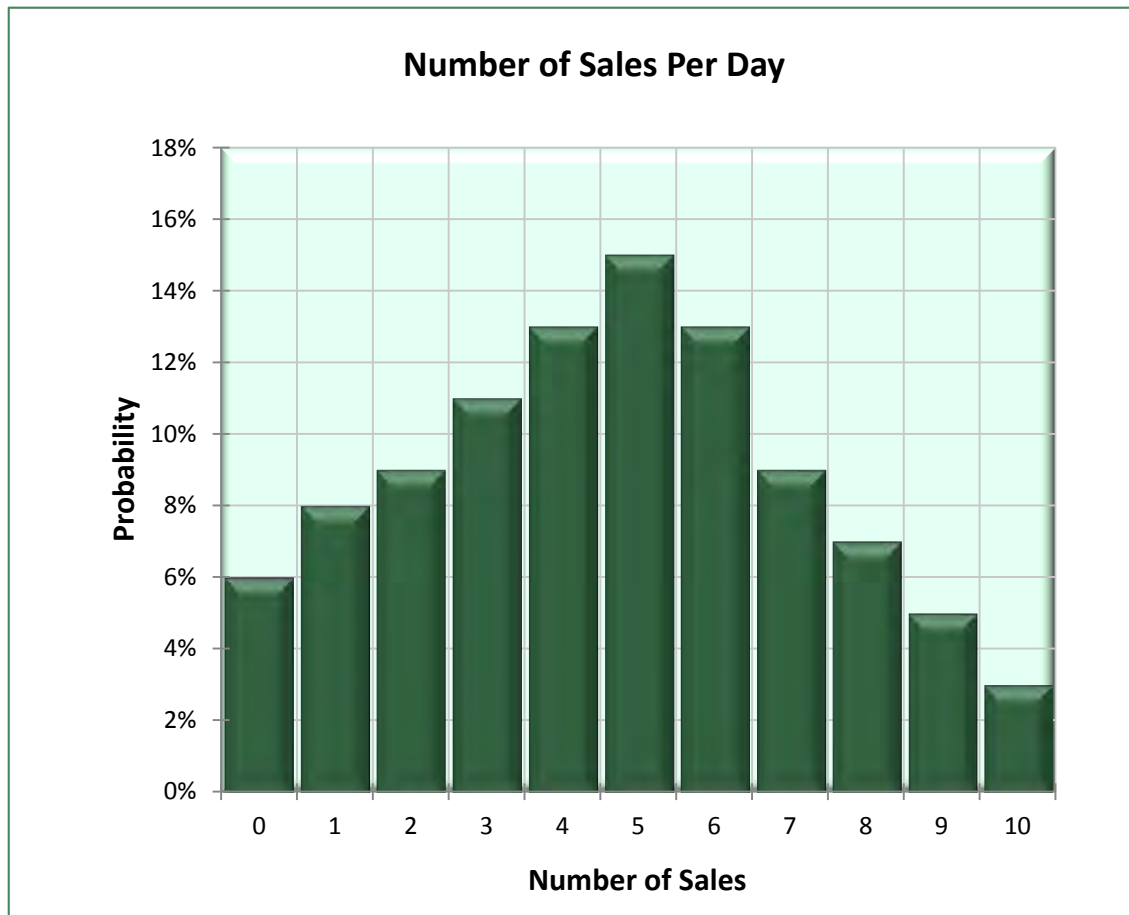
<u>Number of Sales</u>	<u>Number of Days (Frequency)</u>
0	17
1	23
2	29
3	35
4	41
5	47
6	41
7	29
8	23
9	17
10	<u>10</u>
<b>Total</b>	<b>312</b>

Next, we set up the following **probability distribution** based on the **frequency distribution** information listed above (some of the probabilities have been adjusted to compensate for rounding differences so that the probabilities will sum to 1.00):

<u>Number of Sales</u>		<u>Probability</u>
0	17/312	0.06
1	23/312	0.08
2	29/312	0.09
3	35/312	0.11
4	41/312	0.13
5	47/312	0.15
6	41/312	0.13
7	29/312	0.09
8	23/312	0.08
9	17/312	0.05
10	10/312	<u>0.03</u>
<b>Total</b>		<b>1.00</b>

Based on this list, the probability of our store selling no computers in a given day is 6%. The probability that it will sell 10 computers in any one day is 3%. All of the probabilities add up to 100%.

The graph of these values looks like this:



The above is a **discrete probability distribution** because the number of computers sold each day can be counted and these figures are whole numbers (that is, the computer store cannot sell a part of a computer). Therefore, the random variable can take on any number as long as it is a whole number.

The highest probability, 15%, is 5 sales per day. The probability that no computers will be sold on any given day is 6%. The probability that 10 computers will be sold is 3%.

A probability distribution such as the one shown above can be used to compute the **expected value** of the random variable. **Expected value** is the same as the **mean** or **average** of the random variable. In the context of probabilities it is a **weighted average**.

## Expected Value

The expected value of a discrete random variable is the **weighted average of all the possible values** of the random variable. The weights are the probabilities for each of the values. The expected value is the **mean** value, also known as the **average** value. Over the long term, the expected value is the average number of computers that will be sold per day. The symbol for the mean, average, or expected value is  $\mu$  (mu).

**Example:** We continue with the example of the computer store. To determine the number of computers that we expect to sell on an "average" day, we multiply each possible number of computers that could be sold in a day by the probability of that number of computers being sold. By summing all the products of sales times probability, we get the expected number of computers to be sold on an average day.

<u># of Sales</u>		<u>Probability</u>		
0	×	0.06	=	0.00
1	×	0.08	=	0.08
2	×	0.09	=	0.18
3	×	0.11	=	0.33
4	×	0.13	=	0.52
5	×	0.15	=	0.75
6	×	0.13	=	0.78
7	×	0.09	=	0.63
8	×	0.07	=	0.56
9	×	0.05	=	0.45
10	×	0.03	=	<u>0.30</u>

Expected Value/Weighted Average (mean) **4.58**

Obviously, the store will never sell exactly this number since it cannot sell a portion of a computer. But over the long term, the average number of computers the store can expect to sell per day is 4.58.

Question 101: The table below shows the estimated probabilities of the percent of defective units resulting from a production run.

<u>Percent Defective</u>	<u>Probability</u>
2%	30%
3%	50%
4%	20%

The expected percent defective for a production run would be

- a) 1.50%
- b) 2.30%
- c) 2.90%
- d) 3.00%

(ICMA 2010)

## Variance and Standard Deviation

The expected value gives an average or expected result. The **variance** and **standard deviation** both give an idea of the **variability** of the possible values about the mean. The variance and the standard deviation measure how far from the mean (the expected value) the various possible values lie. In the example of the computer store, these values refer to the number of computers sold in a day. If on some days no computers are sold but on other days we sell 10 computers, then the range for the number of computers that could be sold on any given day is fairly large (that is, 0 to 10).

The **variance** is used to **summarize the variability** in the values of a random variable (such as computers sold). Another word for this variability is **dispersion**. The amount of variability in the values of the random variable around their mean (or average) is the amount by which they are **dispersed**, or the amount of their **dispersion**. The amount of dispersion is important because it is a **measurement of risk**. The greater the dispersion of the values around their mean, the greater the risk associated with the values because there is a larger chance that the actual results will be different from the expected value. If the values are highly dispersed about their mean, then they vary widely from their expected value.

For example, the lowest number of one-day computer sales in our probability distribution is 0, the highest is 10, and the mean is 4.58. Consider instead a store where the lowest one-day sales figure is 0, the highest 25, and the mean (expected value) 9.0. The distance from the lowest value to the mean and from the mean to the highest value is greater for the second store than for the first store. Thus the variability of the random variable about their mean for the second store is greater.

If the values vary widely from their expected value, the probability is greater that actual results will vary widely from forecasted results, and that wide variability creates risk. We will discuss this topic more fully a little further on in "Risk, Uncertainty, and Expected Value."

The **variance** of a population is represented by  $\sigma^2$  (sigma squared). The variance is the sum of the squares of all the differences or deviations from the mean (average), weighted according to their probabilities. The difference from the mean of each result is important because it indicates the distance that particular measurement is from its **expected value**. The variance is actually a weighted average of the squared deviations.

The **standard deviation** is the positive square root of the variance. It is represented by  $\sigma$  (sigma). Whereas variance is measured in squared units, standard deviation is measured in the same units as the variable, which in this example is the number of computers sold. Both measures tell us something about how much the various values are dispersed around the mean. The mean in this example is 4.58.

**Example:** Continuing with the table of computers sold per day, we will calculate the **variance** and the **standard deviation**:

Number of Sales $x$	$x - \mu$	$(x - \mu)^2$	Probability	$(x - \mu)^2$ $\times$ Probability
0	$0 - 4.58 = -4.58$	20.9764	0.06	1.2586
1	$1 - 4.58 = -3.58$	12.8164	0.08	1.0253
2	$2 - 4.58 = -2.58$	6.6564	0.09	0.5991
3	$3 - 4.58 = -1.58$	2.4964	0.11	0.2746
4	$4 - 4.58 = -0.58$	0.3364	0.13	0.0437
5	$5 - 4.58 = 0.42$	0.1764	0.15	0.0265
6	$6 - 4.58 = 1.42$	2.0164	0.13	0.2621
7	$7 - 4.58 = 2.42$	5.8564	0.09	0.5271
8	$8 - 4.58 = 3.42$	11.6964	0.07	0.8187
9	$9 - 4.58 = 4.42$	19.5364	0.05	0.9768
10	$10 - 4.58 = 5.42$	29.3764	0.03	0.8813
Total = Variance $\sigma^2 =$				<b>6.6938</b>
Standard deviation $\sigma = \sqrt{6.6938} =$				<b>2.59</b>



In a **normal distribution**, 68.26% of the values are expected to lie within one standard deviation from the mean or expected value. In the above example, the standard deviation is 2.59, meaning that the probability is 68.26% that the actual sales made on any given day will be within  $\pm 2.59$  of the mean. Since the mean is 4.58, the low end of the range of 68.26% probability is 4.58 minus 2.59, which is 1.99. The high end of the range of 68.26% probability is 4.58 plus 2.59, which is 7.17. Thus, the probability is 68.26% that actual sales made on any given day will be between 1.99 and 7.17 computers (or effectively between 2 and 7 computers).

We will define and discuss **normal distributions** and explain these probabilities in the next few pages.

Question 102: The following is a table of probabilities for two separate product lines, X and Y:

<u>Probability</u>	<u>X profit</u>	<u>Y profit</u>
0.20	\$500	\$ 50
0.70	300	400
0.10	600	800

The product line to obtain maximum utility for a risk-averse decision-maker is:

- a) X because it has the highest expected profit.
- b) Y because it has the highest expected profit.
- c) Y because it has the highest dispersion.
- d) X because it has the lowest dispersion.

(Source Unknown)

### Continuous Random Variable Probability Distributions

As discussed earlier, a **continuous random variable** is a variable that can take on any value at all. It does not need to be an integer such as 1, 2, 3, or 4, though it can certainly be an integer. A continuous variable can be 8.456, 10.62, 12.3179, or any other number with any number of decimal points. The actual rate of return on an investment is a continuous random variable because, depending upon its gain (or loss) in market value over time, its total return could be virtually any rate. It could be 3.058%, -5.74%, or any other rate.

When we analyze the probability distribution of a continuous random variable, we cannot list each possible value and its probability the way we can with discrete probability distributions because the number of possible values is infinite. We need a different method for computing probabilities. For continuous random variables, we consider probability in terms of the probability that a variable will have a value **within a specified interval**. The probability of the variable having a value within a given interval is defined as the area under a curve on a graph called a **probability density function**.

The most important type of continuous distribution is the **normal probability distribution**.

### Normal Probability Distributions

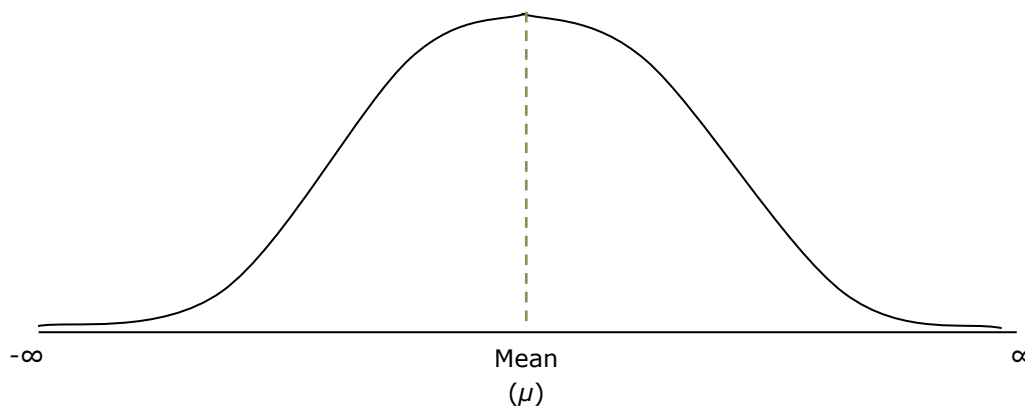
The normal probability distribution is the most important distribution, and it is often found in both nature and in human-made things. The normal distribution that most people are most familiar with is the "curve" used when grading is done "on the curve." Grading on the curve assumes that the greatest number of students in any given class will do average work while smaller numbers of students will do better than average and worse than average, with the number of students doing better and worse becoming lower the further away the scores get from the average (or mean). A teacher then assigns grades based on this assumption.

One problem with this method of assigning grades is that grading is done on a relative basis rather than an absolute basis. Thus, for a student in an exceptionally gifted class, an 85% might equate to a grade of C (average), whereas the same student in an exceptionally slow class who scores 85% might receive a grade of

A (excellent). But on an absolute basis, a grade of 85% should be a B. However, in other uses, the normal distribution is a very useful curve because it does tend to describe many distributions of data.

In a normal distribution, the area under the curve of the graph is used as a measure of probability. The probability of the random variable's taking on a value within some given interval on the x-axis is defined as **the area under the curve on the graph of the probability density function over the interval**.

The curve of a normal distribution of a continuous random variable looks like the following, with the highest portion in the middle. The amount of the area under the curve from one value of  $x$  to another value of  $x$  on the horizontal axis represents the probability of the random variable's taking on a value within that interval on the x-axis. The area under the whole curve is 1 or 100% of the possible data points. Thus the area, meaning the percentage of the total area, of any interval from one value of  $x$  to another value of  $x$  represents the probability percentage of any given result's falling within that interval.



Notice that the graph of a continuous random variable is a smooth line, whereas the graph of a discrete random variable takes the shape of steps (as seen in the graph of computer sales).

In a normal distribution, the probability of values near the mean occurring is greater than the probability of values on the far left of the mean (far below the mean) or the probability of values on the far right of the mean (far above the mean) occurring. Therefore, the graph of a continuous normal probability distribution has the form of a bell-shaped curve that is centered on its mean (as is evident in the above graph). The bell-shaped curve is not always exactly the same height and width. Rather, the **mean** and the **standard deviation** of the distribution define the bell-shaped curve's height and width. Recall that:

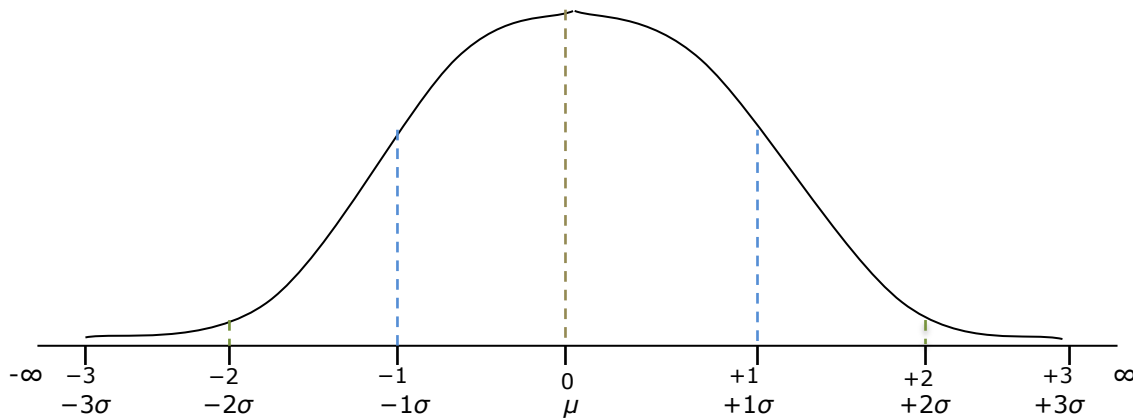
- The **mean** is the **average** of the random variable. It is represented by  $\mu$ . It is the center of the curve and is its highest point.
- The **standard deviation** of a set of data is a measure of the degree of dispersion of the data from the mean value. "Dispersion" describes how much the individual data points are scattered or spread out. A large standard deviation indicates the data points are spread out widely on either side of the mean, whereas a small standard deviation indicates the data points are grouped closely around the mean. The standard deviation is represented by  $\sigma$ .

**The shape of the curve depends on the standard deviation of the random variable.** This is true because:

- The value of the mean ( $\mu$ ) centers the curve.
- The value of the standard deviation ( $\sigma$ ) determines the extent of the curve's spread. A larger standard deviation causes the curve to be flatter and broader than a smaller standard deviation because with a larger standard deviation the dispersion of the data is greater.
- All normal curves have an area under the curve of 1, or 100% of the possible data points. Therefore, the curve must decrease in height and spread out further as the standard deviation increases.
- Thus, the shape of a normal curve is **completely determined by its standard deviation**. In turn, the standard deviation of a set of data is determined by how spread out (dispersed) the various data points are from the mean of the data.

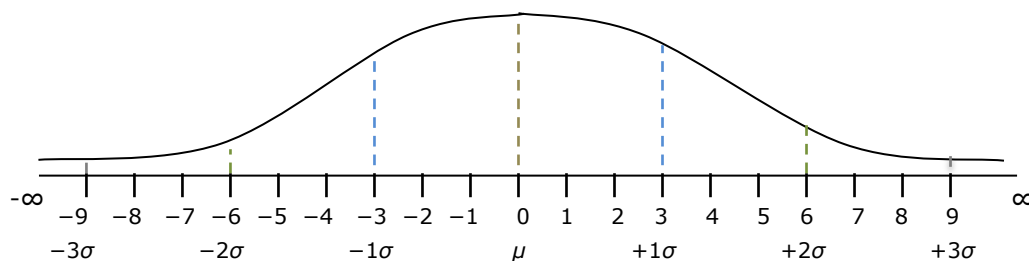
To illustrate the point that the shape of a normal curve is determined by its standard deviation, following are three normal curves. The first and second curves both have means of zero, but the first curve has a standard deviation of 1 and the second curve has a standard deviation of 3. The third curve has a nonzero mean.

**Curve #1: A normal distribution with  $\mu$  of 0 and  $\sigma$  of 1:**



Curve #1 above is called a **standard normal curve** because it is a normal curve with a mean of zero and a standard deviation of 1. It is also called a **theoretical normal curve**. The standard (or theoretical) normal curve is not based on any set of data, which is the reason it is called **theoretical**.

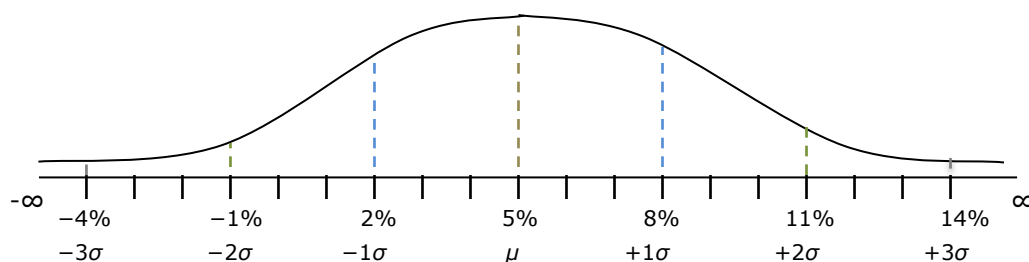
**Curve #2: A normal distribution with  $\mu$  of 0 and  $\sigma$  of 3:**



Curve #2 is a normal curve but it is a **nonstandard** normal curve because its standard deviation is 3, not 1.

Another example of a nonstandard normal distribution is a normal distribution with a mean that is **not** zero. The standard deviation may be 1 or anything else, but because its mean is not zero it is a nonstandard normal distribution. Here is an example of a nonstandard normal curve, using probabilities of returns on an investment as the data set. The mean return is 5% and the standard deviation is 3%:

**Curve #3: A normal distribution with  $\mu$  of 5% and  $\sigma$  of 3%:**



The simplest normal curve to work with is a standard normal curve with  $\mu$  of 0 and a  $\sigma$  of 1. Therefore, nonstandard normal curves are usually reduced (converted) to standard normal curves. This reduction can be

done because for any point on the x-axis of a nonstandard normal curve there is a corresponding point on the x-axis of the standard normal curve. The value on the standard normal curve can be determined by how many standard deviations the point on the nonstandard normal curve is away from the mean.

**Note:** If this explanation is confusing to you at this point, do not be concerned. As you continue reading, the concept will become clearer.

For example, the point  $x = 6$  on Curve #2 above corresponds to the point  $x = 2$  on Curve #1 (the standard normal curve). This correspondence exists because  $x = 6$  on Curve #2 is 2 standard deviations ( $\sigma = 3$ ) away from the mean on that curve, and  $x = 2$  on Curve #1 (the standard normal curve) is also 2 standard deviations ( $\sigma = 1$ ) away from the mean on that curve.

### The Z Score on a Standard Normal Distribution Graph

On a standard normal curve, the unit of measurement on the x-axis is called a **z score**, and the letter **z** is used to designate this particular normal random variable. Any variable  $x$  in a nonstandard normal distribution can be changed to its corresponding **z score** in a standard normal distribution by use of the following formula:

$$z = \frac{x - \mu}{\sigma}$$

Using the mean and standard deviation of Curve #2 above, we convert the value of 6 to its z score in a standard normal distribution as follows:

$$z = \frac{6 - 0}{3}$$

$$z = 2$$

The calculation to convert a value of 2% on Curve #3 to its equivalent z score on a standard normal curve is as follows:

$$z = \frac{2 - 5}{3}$$

$$z = -1$$

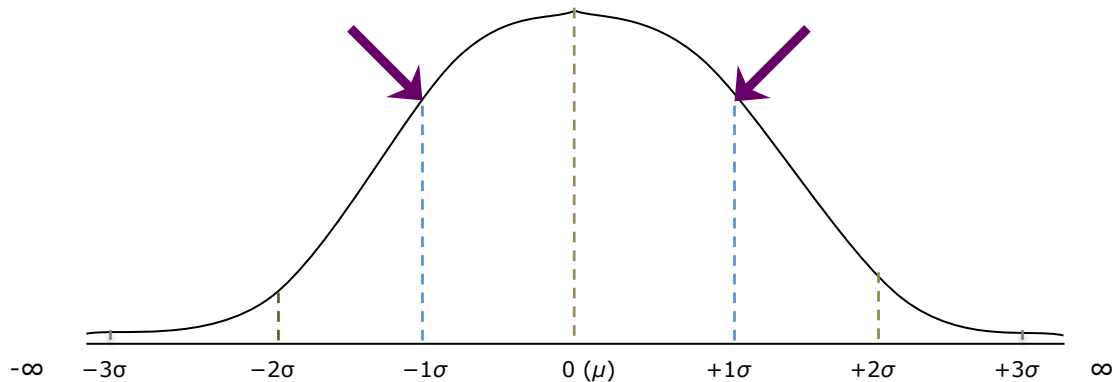
As can be seen on Curve #3, a return of 2% is equivalent to  $-1$  on the standard normal curve because it is 1 standard deviation to the left (the "minus" side) of the mean. The standard deviation of the data set is 3%, and 2% is 3 percentage points (one standard deviation) lower than the mean of 5%.

**Note:** This calculation is provided to show the number of standard deviations a measurement is away from the mean.

## Properties of Normal Distributions

### 1) Standard Deviation and Inflection Points

An interesting property of a normal distribution is that the **inflection points**, meaning the points where the curve changes from bending upward to bending over, are at exactly  $-1\sigma$  and  $+1\sigma$ . Take another look at the graph of a standard normal distribution:



Notice that at  $-1\sigma$  and  $+1\sigma$  the line begins to bend toward the center.

### 2) Mean, Median, and Mode Are the Same

Another interesting property of a normal distribution is that the **mean**, the **median**, and the **mode** are the same value: the point on the x-axis where the curve peaks.

**Mean, median, and mode** are **measures of central tendency**. Measures of central tendency are values typical of a set of data.

- The **mean** is the average of a set of numbers. The mean of a **population** is represented by  $\mu$ . The mean of a **sample** is represented with a bar over the letter representing the variable. For our purposes in forecasting, we do not work with samples.
- The **median** is the halfway value if raw data is arranged in numerical order from lowest to highest. Thus, half the values are smaller than the median and half the values are larger than the median.
- The **mode** is the most frequently occurring value. If all values are unique (different from each other), no mode exists.

### 3) The Mean Divides the Population in Half

When a vertical line is drawn from the peak of the curve to the mean score on the x-axis, the area under the curve to the left of the vertical line is exactly half the total area (50%); the other half (50%) of the area is to the right of the vertical line.

### 4) The Curve Never Ends

The two tails of the curve continue in both directions to infinity, getting closer and closer to the x-axis but never meeting it. The tails of the curve are **asymptotic** to the x-axis, meaning they never cross the x-axis.

Although in theory the curve never ends, the tails are so close to the x-axis that the graph usually shows only the interval from  $-3\sigma$  to  $+3\sigma$ . A few data points do lie beyond the third standard deviation on either side of the mean, however.

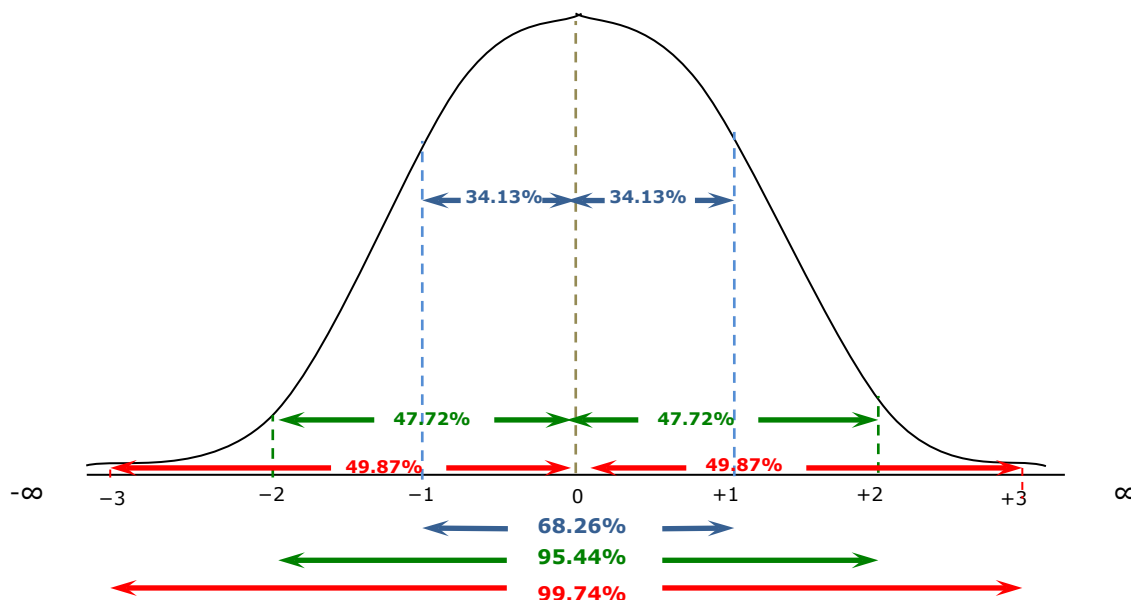
### 5) Probabilities of Specific Z Score Intervals

The most important property of a normal distribution is that the probabilities of a value falling within a given interval have already been calculated for the intervals marked by numbers of standard deviations from the mean.

Tables indicating the percentage of chance (probability) that a result will lie within a certain number of standard deviations from the mean are available. Thus, when we know the mean and the standard deviation, we can use these tables to determine the probability that the actual result will be within a certain range. You do not need to know how the tables were calculated, but you should know that these tables can be used and how to use them.

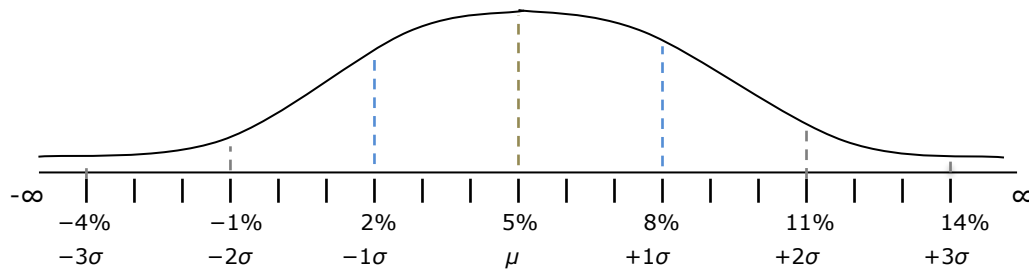
- In a normal distribution, **68.26%** of the values lie within **one standard deviation** of the mean. One-half of those values (34.13%) are on the left side of the mean and one-half (34.13%) are on the right side of the mean.
- In a normal distribution, **95.44%** of the values lie within **two standard deviations** of the mean. One-half of those values, or 47.72%, lie on each side of the mean.
- In a normal distribution, **99.74%** of the values lie within **three standard deviations** of the mean. One-half of those values, or 49.87%, lie on each side of the mean.

The following is an illustration of a standard normal distribution with a mean of 0 and standard deviation of 1. The 68.26%, 95.44%, and 99.74% lines represent the likelihood of a result being within 1, 2, and 3 standard deviations from the mean.



### Use of Normal Distributions in Forecasting Returns on Investments

Normal distributions can be used in forecasting returns on investments. For example, here is a normal distribution of possible returns on an investment, with a  $\mu$  of 5% and a  $\sigma$  of 3%:



By looking at the standard deviations on the graph above, we can see that the probability of the return being between +2% and +8% (that is, from  $-1\sigma$  to  $+1\sigma$ ) is 68.26%. We can also see that the probability of the return being between +5% and +8% is half that amount, or 34.13% (that is, from  $\mu$  to  $+1\sigma$ ).

We can determine the other probabilities of the return being within any interval between any two standard deviations in the same way. For example, the probability of the return being between +5% and -1% ( $\mu$  to  $-2\sigma$ ) is 47.72%. We can calculate that the probability of the return being between +8% and +11% (from  $+1\sigma$  to  $+2\sigma$ ) is 13.59% (47.72% minus 34.13%).

**Note:** When working with continuous probability distributions, we can calculate the probability of the result falling within a given **range**. We cannot calculate the probability of the result being a single point on the graph, such as 9.56%. The probability of the return being exactly 9.56% is infinitely small since the range of possible returns is infinitely large. Therefore, we calculate the probability of a result occurring that is anywhere within a given interval, such as the probability that the return will be between 8% and 11%.

### Calculating Other Probabilities for Normal Probability Distributions

What if we want to know the probability of the investment's return being between 7% and 10%? This is not an interval that begins or ends with the mean or any of the standard deviations on the graph. How can that probability be calculated?

Probabilities for any normal probability distribution are computed by finding the area under the curve for the interval in question. The area under the curve for any interval is **equal to the probability that the random variable will take on a value in that interval**. The total area under any normal curve always equals 1, or 100%, so the portion of the total 100% that is within a given interval is the same as the probability of the random variable's falling within that interval.

The standard normal distribution is used to determine the probability of an event occurring; however, it is not necessary for a normal distribution to be in the form of a **standard** normal distribution for the probabilities to be calculated. As was demonstrated above, any nonstandard normal distribution of data can be converted, regardless of what its mean and its standard deviation are, to a standard normal distribution in order to calculate its probabilities. An  $x$  value on a nonstandard normal distribution can be converted to its corresponding  $z$  score on a standard normal distribution using the formula:

$$z = \frac{x - \mu}{\sigma}$$

This formula is used to convert the two boundaries of an interval on a nonstandard normal distribution to their equivalent  $z$  scores on a standard normal distribution. We then use a table called "Areas of a Standard Normal Distribution" or "Areas or Probabilities for the Standard Normal Distribution" (terms may vary, depending on the source) to find the probability that the random variable will fall within that range.

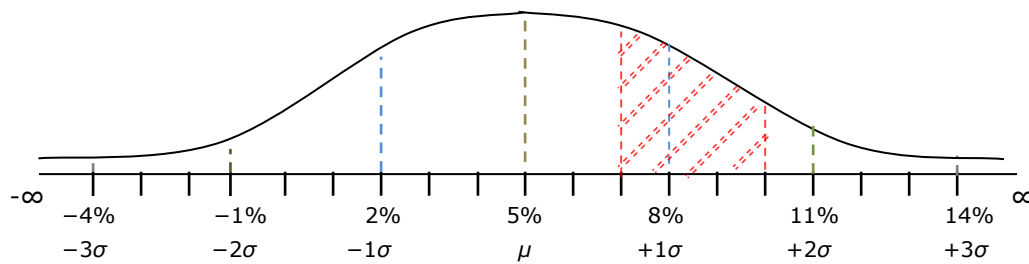
**Table: Areas of a Standard Normal Distribution**

Each entry is the proportion of 1.00 (100%) that is under the entire area of the curve that falls between  $z = 0$  (the mean) and the positive value of  $z$  in the table. Since the standard deviation in a standard normal distribution is 1, the  $z$  scores in the table below are equal to number of standard deviations above the mean. The positive value of  $z$  in this table is at the intersection of the number in the far left column and the number in the top column. For example, the area under the curve between  $\mu = 0$  and  $z = 1.49$  is located across from 1.4 in the left column and below 0.09 in the top column (0.4319). The area from  $\mu$  to  $z = 1.55$  is located across from 1.5 in the left column and below 0.05 in the top column (0.4394). Those proportional areas are highlighted and in bold face type in the table below. The proportional areas for 1, 2, and 3 standard deviations from the mean are italicized and in bold face type in the table below. Areas for negative values of  $z$  are obtained by symmetry.

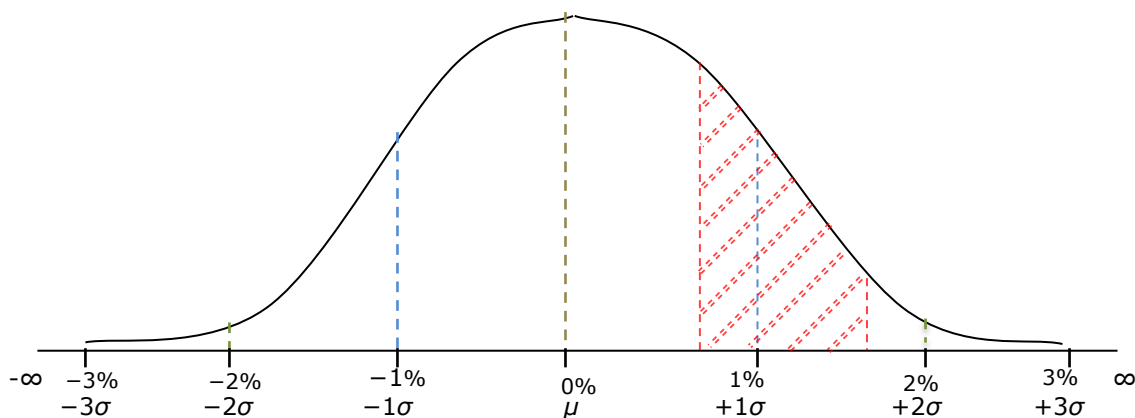
Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	<b>0.3413</b>	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	<b>0.4319</b>
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	<b>0.4394</b>	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	<b>0.4772</b>	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	<b>0.4987</b>	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997



Example #1: In these normally distributed probabilities of return on an investment, find the probability of the return being between 7% and 10%. The desired area is the shaded area on the graph:



The shaded area on the **nonstandard** normal distribution graph above corresponds to the shaded area on the **standard** normal distribution graph that follows:



We first use the formula to convert both the 7% and the 10% to z scores on the standard normal distribution, as follows:

$$z = \frac{x - \mu}{\sigma}$$

Using 10% as  $x$ , 5% as the mean, and 3% as the standard deviation<sup>40</sup>, we convert the value of 0.10 to its z score in a standard normal distribution as follows:

$$z = \frac{0.10 - 0.05}{0.03}$$

$$z = 1.67$$

The right edge of the shaded area on the standard normal graph is at 1.67% or 1.67 standard deviations from the mean.

<sup>40</sup> Although the standard deviation of 3% is not explicitly stated, it can be inferred from the fact that the difference between the mean and the return at 1 standard deviation is 8% – 5% = 3%.

Next, using 7% as  $x$ , 5% as the mean, and 3% as the standard deviation, we convert the value of 0.07 to its  $z$  score in a standard normal distribution as follows:

$$z = \frac{0.07 - 0.05}{0.03}$$

$$z = 0.67$$

The left edge of the shaded area on the standard normal graph is at 0.67% or 0.67 standard deviations from the mean.

The next step is to consult the table, **Areas of a Standard Normal Distribution**, and look up the probabilities for 1.67 and 0.67.

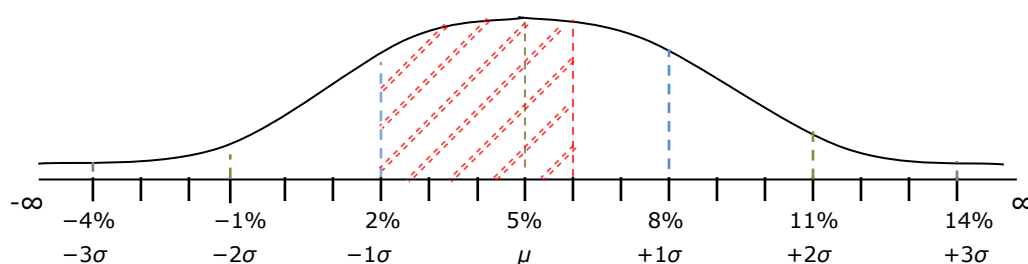
- Look up 1.67 first. In the row across from 1.6 and in the column below 0.07, we find 0.4525. This means the probability of the return being between 5% (the mean, or  $\mu$ ) and 10% is 45.25%.
- Next, look up 0.67. That probability is found in the row across from 0.6 and in the column under 0.07, and it is 0.2486. That means the probability of the return being between 5% ( $\mu$ ) and 7% is 24.86%.

The probability of the return being between 7% and 10% will be the probability of its being between 5% and 10% (45.25%) **minus** the probability of its being between 5% and 7% (24.86%). Therefore, the probability of the return being between 7% and 10% is

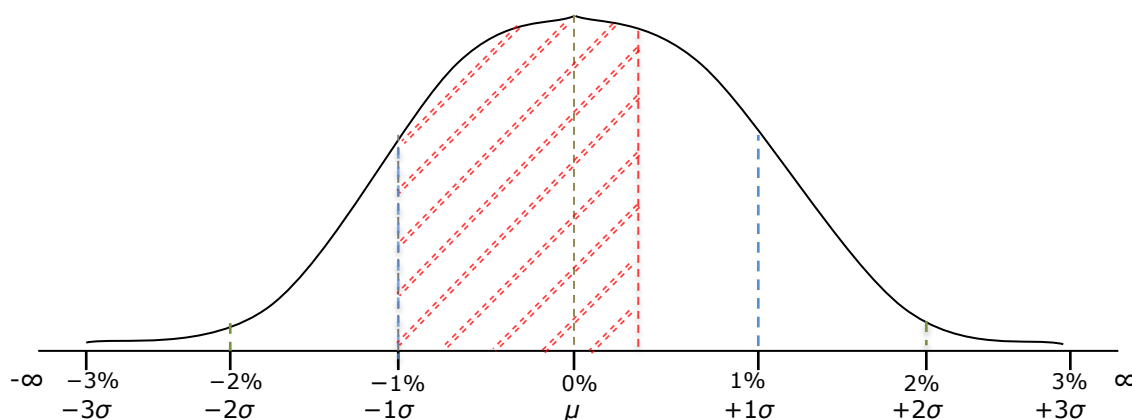
$$45.25\% - 24.86\% = \underline{20.39\%}$$

Example #2: Calculate the probability of the return falling between 2% and 6%. 2% is to the left of the 5% mean, while 6% is to the right of the 5% mean. How do we calculate the probability of the return falling within **that** interval?

The shaded area on the following graph is the area for which we want to find the probability:



As before, the shaded area on the **nonstandard** normal distribution graph above corresponds to the shaded area on the **standard** normal distribution graph that follows:



This time, the interval crosses the mean. First, we must find the probability of the return falling between 5% (the mean) and 6%. Next, we must find the probability of the return falling between 2% and 5% (the mean). The third step will be to **sum** those two probabilities.

Our formula is:

$$z = \frac{x - \mu}{\sigma}$$

Using 6% as  $x$ , 5% as the mean, and 3% as the standard deviation, we convert the value of 0.06 to its  $z$  score in a standard normal distribution:

$$z = \frac{0.06 - 0.05}{0.03}$$

$$z = 0.33$$

The right edge of the shaded area on the standard normal graph is at 0.33% or 0.33 standard deviations from the mean of 0%.

Next, convert 2%. Using 2% as  $x$ , 5% as the mean, and 3% as the standard deviation, convert the value of 0.02 to its  $z$  score in a standard normal distribution:

$$z = \frac{0.02 - 0.05}{0.03}$$

$$z = -1.00$$

The  $z$  score for 2% is  $-1$  standard deviation, which can be seen on the normal, nonstandard, return distribution graph above because 2% is at  $-\sigma$ .

Next, look up  $z = 0.33$  on the table to find the probability of the return being between 5% and 6%. That probability is found across from 0.3 and under 0.03: 0.1293 or 12.93%.

Now, look up  $z = 1.00$  to find the probability of the return being between 2% and 5%. This is located across from 1.0 and under 0.00: 0.3413 or 34.13%. That is the probability of the return falling between the 5% mean and 1 standard deviation to the **right** of 5%, which is actually 8%. However, it is **also** the probability of the return falling between the 5% mean and 1 standard deviation to the **left** of 5%, which is 2%, since the curve is symmetrical (that is, the same shape on both sides of the mean).

This time, instead of subtracting one of these percentages from the other, we must **add** them because the interval we are interested in is partially on the left side of the mean and partially on the right side of the mean. The **sum** of the two separate probabilities is our probability. Therefore, the probability is

$$12.93\% + 34.13\% = \underline{47.06\%}$$

**Exam Tip:** If you get an exam question similar to the above, the "Areas of a Standard Normal Distribution" table will have to be provided in some way. It might be an Exhibit that you click a button to access, a portion of the table might be included in the question, or the question might give you the area percentage(s) needed to answer the question to see if you know how to use them.

## Risk, Uncertainty, and Expected Value

"Risk" can be defined in many ways. One definition has a negative connotation: "a condition in which there is a possibility of an adverse deviation from a desired outcome."

However, in a very real sense risk does not always implicitly carry a negative connotation. Where investments are concerned (both capital investments and security investments), **risk is the possibility that an investment's actual return will differ from its expected return.** This difference may be either positive or negative.

Risk for an investment can be measured by the **variability**, or **dispersion**, of its potential returns around their average, or mean, return. The variance and the standard deviation of a set of potential returns are measurements of their dispersion about the mean. Thus, the risk of an investment is measured by the **variance** and **standard deviation** of its potential returns.

The potential returns of an investment may be expressed in terms of **currency** or in terms of **rate** (percentage) of return on the investment. For a given set of data, the variance and standard deviation are expressed in the same terms as the return.

**Uncertainty** is risk that cannot be measured. For example, we may or may not have information about the historical returns on a particular investment or on similar investments. If no information is available about historical returns for a particular investment, we are in the position of **decision-making under a condition of uncertainty**. When we are in this position, the probability distribution of possible returns must be determined **subjectively**.

For decisions involving risk and uncertainty, we use **expected value** or **expected return** to express the most likely result of our decision, and we use the **variance** and **standard deviation** of the probability distribution of the potential returns as a measurement of the risk associated with the decision.

**Note:** Dispersion is a measurement of risk.

## Expected Value (or Expected Return)

The concept of **expected value** is very important. The expected value of an action is found by multiplying the probability of each potential outcome by its payoff. Therefore, expected value, or expected return, is a **weighted average** of the possible returns, with the weights being the probabilities of occurrence.

A weighted average can be calculated only for **discrete** probability distributions. It is not possible to calculate a weighted average for a continuous probability distribution because the number of possible variables is infinite.

In considering several possible capital budgeting projects, for instance, we would determine **expected cash flow** for each year of each project by means of a discrete probability distribution. The probabilities of each potential cash flow would be determined **subjectively**. The resulting **expected cash flow** (a weighted average of all the potential cash flows, using their probabilities as the weights) for each year of each project is then used in the capital budgeting analysis.

An example of the calculation of expected cash flow for two projects is included in the following pages. For simplicity, we assume each project is a one-year project and thus we have only one year's cash flow to forecast for each project.

## Expected Value in Estimating Future Cash Flows

Estimating, or projecting, future cash flows is an important application of expected value. It is used in capital budgeting analysis for evaluating potential projects. The details of capital budgeting will be covered in the Investment Decisions section of the CMA Part 2 book. For now, however, it is important to know how to calculate estimated future cash flows from a potential project for use in a capital budgeting analysis.

A budgeted amount of future cash flow is often thought of as an absolute number. Unfortunately, though, future cash flows cannot be accurately ascertained because there are many events that can affect a project's net cash flows. Every project has numerous **possible** future cash flows. A project has a **range** of estimated cash flows that reflect different possibilities that management can foresee. To determine the various possible cash flows, management must:

- 1) Determine which influences have affected the net cash flows of similar projects in the past, such as economic conditions, labor conditions, or international conditions, and then
- 2) Make assumptions about each of those events and the manner in which those events might affect the project. For instance, if a recession is expected, management might assume that demand for the project's product will be below normal.
- 3) Once these specific assumptions have been formulated, the financial manager then estimates the impact that each assumption could have on the net cash flow in each year of the project's life. The manager develops several possible cash flow levels for each year, along with probabilities of each cash flow level occurring. This will be a **discrete probability distribution** (not a continuous one), and the probabilities for each year will all sum to 1 or 100%.
- 4) The financial manager will then calculate the **expected value** for the net cash flow for each year of the project's life by calculating the weighted average of all the possible cash flows for each year.
- 5) These calculated expected values of future cash flows will be the cash flows used in the capital budgeting analysis for each year.

**Note: Expected value** is a term that means a **weighted average of the possible values using the probabilities as the weights**. Any time the word "expected" is used in the context of an "expected value" or an "expected cash flow," it refers to the idea of calculating a weighted average of the possible values using the probability of each value as its weight.

To calculate an expected value, multiply each possible value (called a *random variable*) by its probability of occurring and then sum the resulting products.

## Statistical Measurements of Cash Flow Variability

When forecasting cash flows for investment projects, we might make several sets of forecasts for each project to reflect the various alternative states of the economy that might ensue. If we are comparing two project proposals, both for one-year projects, we might make several forecasts for the cash flows, as follows:

	<u>Project X</u>	<u>Project Y</u>
Economy in a deep recession	\$200,000	\$100,000
Economy in a mild recession	250,000	200,000
Economy stable	300,000	300,000
Economy in a minor expansion	350,000	400,000
Economy in a major expansion	400,000	500,000

Suppose economists forecast that the probability of a deep recession occurring next year is 5%, a mild recession is 10%, a stable economy is 50%, a minor expansion is 25%, and a major expansion is 10%. Using these projections we can calculate the expected value of the cash flows for both projects:

	Probability (P)	Project X		Project Y	
		Cash Flow	CF×P	Cash Flow	CF×P
Economy in a deep recession	5%	\$200,000	\$ 10,000	\$100,000	\$ 5,000
Economy in a mild recession	10%	250,000	25,000	200,000	20,000
Economy stable	50%	300,000	150,000	300,000	150,000
Economy in a minor expansion	25%	350,000	87,500	400,000	100,000
Economy in a major expansion	10%	400,000	<u>40,000</u>	500,000	<u>50,000</u>
<b>Expected Value</b>			<b><u>\$312,500</u></b>		<b><u>\$325,000</u></b>

The expected value of the cash flows for each of the two projects is simply a weighted average of the possible cash flows, with the weights being the probabilities of each occurrence. The expected value of Project Y's cash flows is higher than the expected value of Project X's cash flows.

The expected value is the average value, or **mean**, of the possible values. According to the data above, if the same cash flow could be repeated over and over again, 5% of the time the cash flow would be \$200,000, 10% of the time it would be \$250,000, and so forth. The **weighted average** of these potential cash flows is the expected value.

The problem with using expected value as a forecast for a specific project is that any given project has only one opportunity to achieve its cash flow for its duration and then the project is complete. The cash flow actually achieved for Project X could be anywhere from \$200,000 to \$400,000. Once one of the possible cash flows has been achieved, we will know that the probability of **that** cash flow occurring was 100% while the probability of the other cash flows occurring was zero.

An expected value is a "long-run" average value for a random variable. As a result, an expected value is more reliable as a long-run average forecast and less reliable as a forecast for the net cash flow for an individual project at any given moment in time.

Despite not being a reliable forecast, expected value is often used to project future cash flow from individual projects because it is the best method available for obtaining a forecast.

**Note:** To calculate the expected value, multiply each possible value (called a *random variable* in statistics) by its probability of occurring and then sum the resulting products.

## Standard Deviation as a Measure of Risk

The amount of the expected value is not the only important part of the forecast. Variation within the possible cash flows for each project is also important because a project with a high variability of cash flows has more risk than a project for which all the possible cash flows are close together. For Projects X and Y above, the possible cash flows are the five cash flows for each project that could result given the five possible economic scenarios.

In the example of Project X and Project Y, Project X's possible cash flows range from a low of \$200,000 to a high of \$400,000, and their expected value (the mean, or weighted average) is \$312,500. Project Y's possible cash flows range from a low of \$100,000 to a high of \$500,000, and their expected value is \$325,000. Which project's cash flow carries more risk?

The standard deviations of both projects are not known because they have not yet been calculated; therefore, the coefficient of variation cannot yet be calculated for each project. However, a casual glance at the ranges of their potential cash flows reveals that **Project Y's cash flow is riskier because the range of possible cash flows is greater**. That is, the low is lower and the high is higher, and both the lowest and the highest

cash flows are further from their expected value as compared to Project X. This range of possible cash flows is called the **dispersion** of the possible cash flows about their means. The range of possible cash flows for each project can be determined by simply looking at the lowest and the highest potential cash flows for each.

The riskiness of each project can be inferred from this dispersion, or variability, of the distribution of the possible results. The usual method of expressing dispersion of results is the standard deviation. The standard deviation of a set of data is a measure of the degree of dispersion of the data from the mean value. "Dispersion" describes how much the individual data points are scattered or spread out. A larger standard deviation indicates the data points are farther from the mean, whereas a smaller standard deviation indicates the data points are grouped more closely around the mean.

The variance and standard deviation of each of the expected cash flows is calculated in the same way as the variance and standard deviation of the number of computers sold each day was calculated in the example of the computer store. The narrower the distribution of the data, the lower the standard deviation will be. The lower the standard deviation, the lower the risk. The wider the distribution of data, the higher the standard deviation and the higher the risk.

**Standard deviation** is a measure of the **dispersion of a probability distribution** and thus a measure of the **riskiness of a project**.

**Points to remember about variance and standard deviation:**

- The variability, or dispersion, of forecasted results about their mean is used to quantify risk.
- The standard deviation of a set of data is used to describe the dispersion of the data about their mean.
- The mean is the weighted average of the data and also the expected value.
- The narrower the distribution of the data is from the highest to the lowest data points, the smaller the standard deviation will be and the lower the risk.
- The wider the distribution of data is from the highest to the lowest data points, the greater the standard deviation will be and the greater the risk will be.

### The Coefficient of Variation (Risk Per Unit of Return) as a Measure of Relative Risk

The more widely that investment returns are dispersed (and the larger the size of the standard deviation), the greater will be the potential for loss or gain and thus the riskiness of the investment increases.

The **coefficient of variation** is a measure of risk per unit of expected return. The coefficient of variation compares the amount of the variation from the expected return with the amount of the expected return. The coefficient of variation is calculated as follows:

$$\text{Coefficient of Variation} = \frac{\text{Standard Deviation}}{\text{Expected Return}}$$

Or, stated another way,

$$\text{Coefficient of Variation} = \frac{\sigma}{\mu}$$

The higher the coefficient of variation is, the riskier the investment is **relative to its expected return**.

Just because one project is determined to be "riskier" than another project does not mean that the company will always choose the less risky option. There may be times when a company is willing to take on the additional risk in order to attempt greater returns. The coefficient of variation is not a deciding factor. It is simply one of the tools that will be used to evaluate the risk of different projects.

Example #1: We are comparing two investment projects. Both have expected returns of 20%, but the standard deviation of Project A's returns is 15%, while the standard deviation of Project B's returns is 9%. Which one is relatively riskier?

$$\text{CV of Project A} = 0.15 \div 0.20 = 0.75$$

$$\text{CV of Project B} = 0.09 \div 0.20 = 0.45$$

Because it has a higher coefficient of variation, Project A is the relatively riskier project.

Example #2: Two investments have different expected returns. Project A's expected return is 20% and the standard deviation of its returns is 15% (the same as in Example #1). Project B's expected return is only 10%, while the standard deviation of its returns remains at 9%. Which project is relatively riskier?

$$\text{CV of Project A} = 0.15 \div 0.20 = 0.75$$

$$\text{CV of Project B} = 0.09 \div 0.10 = 0.90$$

Because Project B's expected return has decreased from 20% to 10%, Project B's coefficient of variation has increased from 0.45 to 0.90. Therefore, Project B is now the relatively riskier project.



## Example of Standard Deviation and Coefficients of Variation

**Example:** This example continues with Project X and Project Y. The cash flow projections and the probabilities of each are as follows for Project X and Project Y:

	<u>Probability</u>	<u>Project X</u>	<u>Project Y</u>
Deep recession	5%	\$200,000	\$100,000
Mild recession	10%	250,000	200,000
Stable economy	50%	300,000	300,000
Minor expansion	25%	350,000	400,000
Major expansion	10%	400,000	500,000

The standard deviation of Project X's cash flow is:

Possible Cash Flows	Proba-bility (P)	<u>(CF×P)</u>	<u>(CF – Expected CF)<sup>2</sup> × P</u>
\$200,000	0.05	\$ 10,000	$(\$200,000 - \$312,500)^2 \times 0.05 =$ 632,812,500
250,000	0.10	25,000	$(\$250,000 - \$312,500)^2 \times 0.10 =$ 390,625,000
300,000	0.50	150,000	$(\$300,000 - \$312,500)^2 \times 0.50 =$ 78,125,000
350,000	0.25	87,500	$(\$350,000 - \$312,500)^2 \times 0.25 =$ 351,562,500
400,000	0.10	<u>40,000</u>	$(\$400,000 - \$312,500)^2 \times 0.10 =$ <u>765,625,000</u>
Total		\$312,500	\$2,218,750,000 (variance)

The **Standard Deviation  $\sigma$**  = the square root of 2,218,750,000, or **\$47,104**

Assuming the returns are normally distributed, we can conclude that the probability is 68.26% that the **actual** cash flow will be within  $\pm\$47,104$  of \$312,500 or between \$265,396 ( $\$312,500 - \$47,104$ ) and \$359,604 ( $\$312,500 + \$47,104$ ).

The Standard Deviation of Project Y's cash flow is:

Possible Cash Flows	Proba-bility (P)	<u>(CF×P)</u>	<u>(CF – Expected CF)<sup>2</sup> × P</u>
\$100,000	0.05	\$ 5,000	$(\$100,000 - \$325,000)^2 \times 0.05 =$ \$2,531,250,000
200,000	0.10	20,000	$(\$200,000 - \$325,000)^2 \times 0.10 =$ 1,562,500,000
300,000	0.50	150,000	$(\$300,000 - \$325,000)^2 \times 0.50 =$ 312,500,000
400,000	0.25	100,000	$(\$400,000 - \$325,000)^2 \times 0.25 =$ 1,406,250,000
500,000	0.10	<u>50,000</u>	$(\$500,000 - \$325,000)^2 \times 0.10 =$ <u>3,062,500,000</u>
Expected Cash Flow		\$325,000	\$8,875,000,000 (variance)

The **Standard Deviation  $\sigma$**  = the square root of 8,875,000,000, or **\$94,207**

The probability is 68.26% that the **actual** cash flow will be within  $\pm\$94,207$  of \$325,000, or between \$230,793 and \$419,207.

Project Y has a much higher standard deviation than Project X, meaning that Project Y has a **greater dispersion of possible outcomes**. Therefore, **Project Y has greater absolute risk than Project X**. Note that this is the same conclusion we derived from looking at the possible cash flows for each project.

However, now that we know the standard deviations of the cash flows for each project as well as their expected values, we can also determine which project carries more risk **relative to its expected return** by calculating their **Coefficients of Variation**.

The Coefficient of Variation =  $\sigma \div \mu$ . Therefore, the Coefficients of Variation are:

CV of Project X =	$47,104 \div 312,500 = 0.15$
CV of Project Y =	$94,207 \div 325,000 = 0.29$

We can definitely say that Project Y has greater risk, both on an absolute basis and relative to its expected return, than Project X.

How is this information useful? Assume that in the example above, Project X and Project Y both entail the same initial investment and that they are of the same length (one year). Furthermore, assume that they are mutually exclusive projects, meaning that in choosing X we cannot choose Y, and vice versa. The expected value of the cash flow from Project Y (\$325,000) is greater than the expected value of the cash flow from Project X (\$312,500). Should we choose Project Y because its expected cash flow is higher? Does the higher expected cash flow for Project Y offset the increased risk we would be taking if we embark upon that project?

The answer to those questions is a matter of professional judgment. Standard deviation as a measure of the variability of results along with expected value can be used to quantify risk and thus assist in the decision-making process.

### The Expected Value of Perfect Information

Assume that an economic forecasting service is available that can reveal the future state of the economy with absolute certainty. This service has a proprietary computer model that has never been wrong, but the service costs \$35,000. Should we purchase it?

Perfect information is knowledge about the future that would enable us to make the best choice today for any possible situation in the future. If we knew in advance the future state of the economy, we could make a much more informed choice between Project X and Project Y.

As we calculate the expected value of this perfect information, keep in mind that **we do not know in advance what the perfect information will be**. In other words, we must determine what it would be worth to us to know this perfect information **before we know what we are buying**.

To begin, review the expected value table with the various possible future states of the economy, the probabilities, and the cash flows from the two projects that will result under each state:

	Probability (P)	Project X		Project Y	
		Cash Flow	CF×P	Cash Flow	CF×P
Economy in a deep recession	5%	\$200,000	\$ 10,000	\$100,000	\$ 5,000
Economy in a mild recession	10%	250,000	25,000	200,000	20,000
Economy stable	50%	300,000	150,000	300,000	150,000
Economy in a minor expansion	25%	350,000	87,500	400,000	100,000
Economy in a major expansion	10%	400,000	40,000	500,000	50,000
<b>Expected Value</b>			<b><u>\$312,500</u></b>		<b><u>\$325,000</u></b>

For this example, if we knew in advance that the economy would be in a deep recession, we would select Project X and we would gain \$200,000 in cash flow instead of the \$100,000 we would gain by investing in Project Y. If we knew the economy would be in a mild recession, we would also choose Project X and we would gain \$250,000 instead of \$200,000. But if we knew in advance that the economy would be in a minor expansion, we would select Project Y and gain \$400,000 in cash flow instead of \$350,000. If we knew the economy would be in a major expansion, we would also choose project Y and would gain \$500,000 in cash flow instead of \$400,000. If we knew the economy would be stable, it would make no difference which project we chose, because cash flow for either project would be \$300,000.

Should we therefore buy the information from the economic forecast service that will enable us to make the best decision for whatever forecast we receive?

The **expected value of perfect information (EVPI)**, or the maximum price we would be willing to pay for perfect information, is the difference between the expected value of the cash flow **with perfect information** (EVwPI) and the expected value of the cash flow that would result from making the **best decision** that we can **without perfect information** (EVwoPI).

$$\text{EVPI} = \text{EVwPI} - \text{EVwoPI}$$

The expected value of the cash flow **without perfect information** is simply the expected value, or the weighted average of the possible cash flows with the weights being the probabilities of each cash flow occurring.

The expected value of the cash flow **with perfect information** (EVwPI) is the weighted average of the **best** decisions that can be made under each possible state of the economy, weighted according to the probability of each state occurring, as follows:

$$\text{EVwPI} = (0.05 \times \$200,000) + (0.10 \times \$250,000) + (0.50 \times \$300,000) + (0.25 \times \$400,000) + (0.10 \times \$500,000) = \underline{\$335,000}.$$

The expected value of the cash flows from Project X (expected value without perfect information) is \$312,500, and the expected value of the cash flows from Project Y (without perfect information) is \$325,000. If we select Project Y as our best choice **without perfect information**, the value of the perfect information is:

$$\text{EVPI} = \$335,000 - \$325,000 = \mathbf{\$10,000}$$

If we select Project X as our best choice without perfect information, the value of the perfect information is:

$$\text{EVPI} = \$335,000 - \$312,500 = \mathbf{\$22,500}$$

Thus, the expected value of the economic forecast service is either \$10,000 or \$22,500, **depending upon which project we are inclined to select without the forecast**. Therefore, the price of the economic forecast service (\$35,000) is greater than the maximum amount we would be willing to pay regardless of which project we are inclined to select. Therefore, we have decided not to purchase the forecast service.

## The Opportunity Loss, or Regret, Table as a Decision-Making Tool

Another method to decide between Project X and Project Y is to set up an **opportunity loss table**, also called a **regret table**, and calculate the expected opportunity loss from each project.

An opportunity loss is the **difference** between the payoff for a decision made and the payoff that **would have been received** if the best decision had been made for the circumstances. An opportunity loss table is derived from the payoff table we used to calculate the expected values of the cash flows for the two projects. In our opportunity loss table, we use 0 as the opportunity loss corresponding to the best decision for each option (because there is no opportunity loss with that decision); and for other decisions, we calculate the opportunity loss as the difference between the cash flow received from that decision and the cash flow that would have been received from having made the best decision. Thus our **opportunity loss, or regret, table** looks like this:

	Probability (P)	Project X		Project Y	
		Cash Flow	CF×P	Cash Flow	CF×P
Economy in a deep recession	5%	\$ 0	\$ 0	\$100,000	\$ 5,000
Economy in a mild recession	10%	0	0	50,000	5,000
Economy stable	50%	0	0	0	0
Economy in a minor expansion	25%	50,000	12,500	0	0
Economy in a major expansion	10%	100,000	<u>10,000</u>	0	<u>0</u>
<b>Expected opportunity loss</b>			<b><u>\$22,500</u></b>		<b><u>\$10,000</u></b>

The expected opportunity loss amounts are the same as the amounts that were calculated above as the value of perfect information if we were to select each project.

Notice also that the expected opportunity loss is greater with Project X than with Project Y. The rule to follow with an opportunity loss table is: **The minimum expected opportunity loss provides the best decision alternative.**

### Points to remember about expected opportunity loss:

- The expected opportunity loss amounts are always equal to the expected value of perfect information, and the expected value of perfect information is dependent upon which option we are inclined to select without perfect information.
- The minimum expected opportunity loss always provides the best decision alternative.

Therefore, at this point it would be recommended that management not purchase the economic forecast service and select Project Y, even though it is riskier.

The reasons for recommending Project Y without the perfect information are:

- Project Y has the minimum expected opportunity loss (\$10,000 versus \$22,500 for Project X).
- Project Y also has the greater expected payoff (\$325,000 versus \$312,500 for Project X).
- Although the expected cash flows from Project Y are more variable and therefore more risky than Project X's cash flows, we believe the probability of Project Y being the wrong choice is small. According to our probability table, the probability of the economy remaining stable or expanding is 85% (50% + 25% + 10%). If the economy remains stable or expands, Project Y will be the better choice. Therefore, in choosing Project Y we face only a 15% probability that future events will prove that we chose incorrectly.

### Last Words on Probability, Risk and Expected Value

Probability is a numerical measurement of uncertainty. When a probability is based on counting and observed frequencies, it is **objective**. When a probability is an expression of whether an event in business will or will not occur, it may be based on the relative frequency of similar events having occurred in the past, or it may be based on someone's judgment. Either way, the determination of probability has strong **subjective** elements.

Therefore, the concept of probability as it is used in business is a numerical measure of the **belief of an individual** in the occurrence or non-occurrence of an event. The probability assigned to an event depends upon the information and knowledge that the decision-maker has and uses in assessing the probability. As such, probability assessment is clearly subjective, individual, and dependent upon information. In fact, it has been said that probability does not exist in any absolute or objective sense.

Thus, these statistical methods of dealing with risk and uncertainty are only **means of obtaining a recommended decision alternative or an optimal strategy** for the purpose of planning, budgeting, and decision-making. The actual results from the implementation of the decision will probably be quite different from the calculated expected value. **The decision-maker's judgment is the deciding factor.**

Question 103: A company uses two major material inputs in its production. To prepare its manufacturing operations budget, the company has to project the cost changes of these material inputs. The cost changes are independent of one another. The purchasing department provides the following probabilities associated with projected cost changes:

<u>Cost Change</u>	<u>Material 1</u>	<u>Material 2</u>
3% increase	0.3	0.5
5% increase	0.5	0.4
10% increase	0.2	0.1

The probability of a 3 percent increase in the cost of both Material 1 and Material 2 is:

- a) 15 percent
- b) 40 percent
- c) 80 percent
- d) 20 percent

(CIA Adapted)

Question 104: Ron Bagley is contemplating whether to investigate a labor efficiency variance in the Assembly Department. It will cost \$6,000 to undertake the investigation and another \$18,000 to correct operations if the department is found to be operating improperly. If the department is operating improperly and Bagley failed to make the investigation, operating costs from the various inefficiencies are expected to amount to \$33,000. Bagley would be indifferent between investigating and not investigating the variance if the probability of improper operation is:

- a) 0.29
- b) 0.40
- c) 0.60
- d) 0.71

(CMA Adapted)

Question 105: Ryerson Company has three sales departments, each contributing the following percentages of total sales: clothing, 50 percent; hardware, 30 percent; and household sundries, 20 percent. Each department has had the following average annual damaged goods rates: clothing, 2 percent; hardware, 5 percent; and household sundries, 2.5 percent. A random corporate audit has found a weekly damaged goods rate of sufficient magnitude to alarm Ryerson's management. The probability (rounded) that this rate occurred in the clothing department is:

- a) 50 percent
- b) 1 percent
- c) 25 percent
- d) 33 1/3 percent

(CMA Adapted)

Question 106: Two firms share customers in the same market. Firm A sampled its customers' buying habits and found that about 70 percent were repeat customers each week, while 30 percent went to Firm B. Firm B found that 80 percent of its customers remained loyal each week, while 20 percent switched to Firm A. If this retention and loss of customers continues for a long period, the percentage of customers Firm A will have is:

- a) 70 percent
- b) 80 percent
- c) 60 percent
- d) 40 percent

(CMA Adapted)

Question 107: A beverage stand can sell either soft drinks or coffee. If the stand sells soft drinks and the weather is hot, it will make \$2,500; if the weather is cold, the profit will be \$1,000. If the stand sells coffee and the weather is hot, it will make \$1,900; if the weather is cold, the profit will be \$2,000. The probability of cold weather on a given day at this time is 60%.

The expected payoff for selling coffee is:

- a) \$1,360
- b) \$2,200
- c) \$3,900
- d) \$1,960

(CMA Adapted)

Question 108: Carson Products sells sweatshirts and is preparing for a World Cup Soccer match. The cost per sweatshirt varies with the quantity purchased as follows.

<u>Quantity</u>	<u>Unit Cost</u>
4,000	\$14.00
5,000	13.50
6,000	13.00
7,000	12.50

Carson must purchase the shirts one month before the game and has analyzed the market and estimated sales levels as follows.

<u>Unit Sales</u>	<u>4,000</u>	<u>5,000</u>	<u>6,000</u>	<u>7,000</u>
Probability	15%	20%	35%	30%

The estimated selling price is \$25 for sales made before and during the day of the game. Any shirts remaining after game day can be sold at wholesale to a local discount store for \$10.

The expected profit if Carson purchases 6,000 shirts is

- a) \$64,500
- b) \$66,000
- c) \$69,000
- d) \$72,000

(ICMA 2010)

## Dispersion and Standard Deviation Summary

The **standard deviation** of the probability distribution of these subjectively determined potential cash flows expresses the **dispersion**, or **variability**, of possible returns around the **expected return**. If the standard deviation is large, it means the variability of returns is large and the risk of the project is higher. Thus, standard deviation is a measure of risk. By expressing differences from the expected return in terms of numbers of standard deviations from the mean (expected return), we can state the probability that the actual return will fall within an interval relative to the mean, or expected return. The greater the standard deviation, the greater is the potential for loss or gain.

Standard deviation is always expressed in the same units as the distribution. Thus, if the distribution is a distribution of annual rates of return on an investment, the returns and the standard deviation of the returns are both expressed as annual percentages. If the distribution is a distribution of annual cash flows in units of currency, both the cash flows and the standard deviation of the cash flows will be expressed as currency amounts.

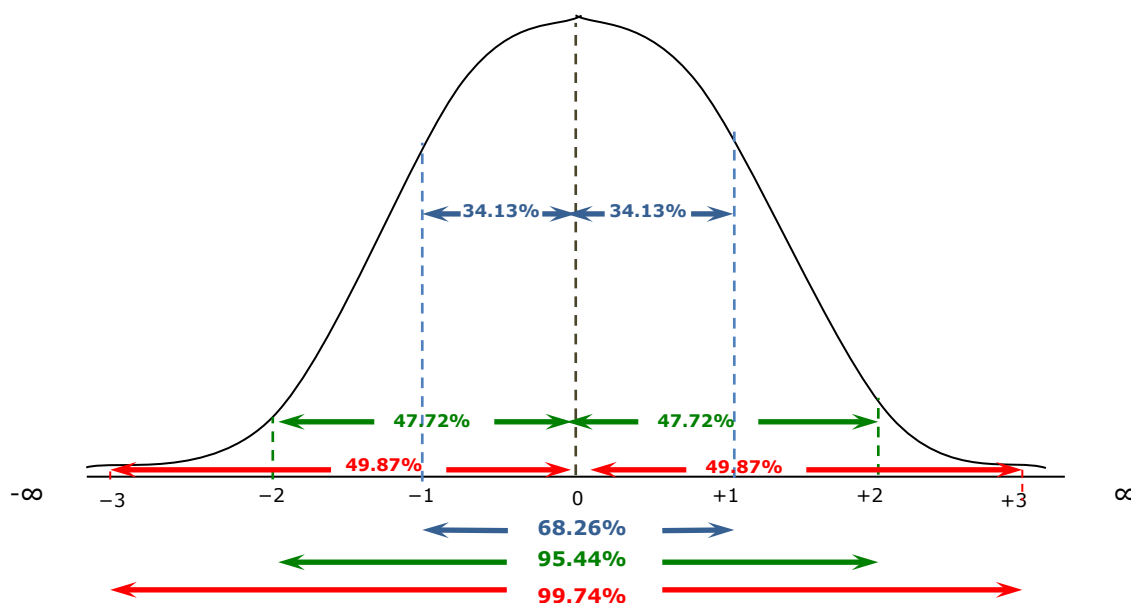
For example, the standard deviation on our graphs of potential returns under the earlier topic "Use of Normal Distributions in Forecasting Returns on Investments" was 3%, while the mean, or expected return, was 5%. So, based on the Areas of a Standard Normal Distribution table, we saw that the probability of the return being between 2% (one standard deviation to the left of the mean) and 5% (the mean) was 34.13%, while the probability of the return being between 5% (the mean) and 8% (one standard deviation to the right of the mean) was also 34.13%. Thus, the probability of the return being between 2% and +8% (−1 standard deviation and +1 standard deviation from the mean) was 34.13% + 34.13%, or 68.26%. The probability of the return being between −1% and +11% (−2 standard deviations and +2 standard deviations from the mean) was 47.72% + 47.72%, or 95.44%. And the probability of the return being between −4% and +14% (between −3 standard and +3 standard deviations from the mean) was 49.87% + 49.87%, or 99.74%.

What is the probability of the return being less than  $-4\%$ ? It is one-half of  $(100\% - 99.74\%)$ , or

$$0.5(1 - 0.9974) = 0.0013 \text{ or } \underline{0.13\%}$$

This 0.13% represents the area beyond the third standard deviation in **one** of the tails of the distribution, either the left tail or the right tail. Therefore, the probability of the return being greater than  $14\%$  is **also** 0.13%. Note that  $99.74\% + 0.13\% + 0.13\% = 100.0\%$ .

Here is the standard normal probability graph again, with 1, 2, and 3 standard deviations marked and the area under the curve between each standard deviation and the mean (which is zero) also marked.



Furthermore, we are not limited to determining the probabilities associated only with intervals that are 1, 2, and 3 standard deviations from the mean. We can calculate the probability of the return falling within the interval between **any** two returns on a graph of a normal probability distribution by converting the  $x$  values to their equivalent  $z$  scores on a standard normal probability distribution graph.

Any normal distribution can be converted to a **standard** normal distribution with a mean of 0 and standard deviation of 1 using the following formula for the two boundaries of the interval in question, where the  $x$  = a boundary,  $\mu$  = the mean (or expected value), and  $\sigma$  = the standard deviation of the probability distribution:

$$z = \frac{x - \mu}{\sigma}$$

After this calculation has been made for each of the two boundaries, the table **Areas of a Standard Normal Distribution** can be used to calculate the probability of the return falling within the interval we are interested in on the graph.



## Top-Level Planning and Analysis

### Pro Forma Financial Statements

In business, the term “pro forma” is used to describe some kind of data, usually financial statements, where the data is on an “as if” basis; that is, as if something in particular had happened. Pro forma financial statements, prepared for internal use in the planning process, are financial statements containing projected amounts that are expected if a particular course of action is followed. Pro forma financial statements are used in order to see what the financial statements of the firm will look like if something that is under consideration or forecasted actually happens. Pro forma financial statements are often used to evaluate the effects on the company’s finances if a particular sales forecast is realized, although they can be used for other “what if” scenarios as well.

By analyzing pro forma statements, managers can tell what the company’s cash position will be, whether it will need to borrow, whether it will be able to make its scheduled loan payments, whether it will remain in compliance with debt covenants, and so forth.

Pro forma financial statements are not the same thing as the master budget financial statements, although one or several versions of pro forma financial statements may be prepared as a part of the formal planning process that will eventually result in the master budget. Pro forma statements may be prepared after the formal budget for the year has been adopted, if the company is considering an activity that was not foreseen before the formal budget was adopted. Pro forma financial statements are not prepared individually for each department and then consolidated into budgeted statements for the whole company the way budgeted financial statements are. They may be prepared for the company as a whole or for only one department or division.

Pro forma financial statements include a pro forma income statement, a pro forma statement of financial position (balance sheet), and a pro forma statement of cash flows. In other words, they are a complete set of financial statements using **projected** amounts that tie together just like the amounts in the actual financial statements.

The term “pro forma” is sometimes used to refer to the master budget financial statements as well, but this is an inappropriate use of the term. This text uses the term “pro forma” properly; however, be aware that “pro forma” might be used improperly elsewhere, possibly even on the exam.

Pro forma financial statements are used internally for five general purposes:

- 1) A pro forma financial statement is used to compare the company’s anticipated performance with its target performance and with investor expectations.
- 2) Pro forma statements are used for “what if” analysis in order to forecast the effect of a proposed change. For example, if the company is contemplating a price increase that it anticipates will reduce the level of demand for its product, it will prepare a pro forma financial statement to determine the result on the financial statements if the price increase is put into effect.
- 3) They are used to determine in advance what the company’s future financing needs will be.
- 4) Various cash flow projections and sets of pro forma statements may be prepared using different assumptions for different operating plans. They are used to forecast the capital requirements of the plans in order to select the plan that maximizes shareholder value.
- 5) Pro forma financial statements are used to determine whether the company will be able to remain in compliance with the required covenants on its long-term debt.

Pro forma financial statements may also be prepared by someone outside the company. For example, an investor or security analyst might prepare pro forma financial statements in order to forecast a company’s future earnings, cash flows, and stock price. However, in this text “pro forma” refers to top-level planning that takes place **within** organizations.

## Forecasting for Planning

Various approaches to forecasting are used, depending upon the situation. The three primary approaches are:

- 1) **Experience:** Because sales, expenses, or earnings have grown at a particular rate in the past, we assume they will continue growing at that rate in the future. This leads to trend projections.
- 2) **Probability:** We assume something will happen in the future because the laws of probability indicate it will. For example, probability is used to forecast the expected value of future cash flows from a proposed capital budgeting project.
- 3) **Correlation:** Because there has been a high correlation in the past between one factor and another factor, such as increased advertising leading to increased sales, we use what we know about the first factor to forecast the second factor.

Since past performance is no guarantee of future performance, all forecasts are subject to being wrong, and sometimes they are very far off. Yet although forecasts are not 100% accurate, forecasting is necessary. Forecasts of expected future situations are used to make decisions today. New products are planned, marketing and promotion plans are made, production quotas are set, and required financing is arranged based upon forecasts.

## Sales Forecasting

In the Forecasting section of this book, we showed how to use historical sales information to develop a trend line to use in forecasting the next year's sales. Although history is useful, future sales are affected by events occurring in the future, not events that happened in the past. Therefore, future sales will depend upon the state of the domestic and global economy, the growth prospects for the market the company operates in, the company's future share of that market, the company's product line, new products that the company may be planning to introduce, and the company's marketing efforts. The historical sales growth rate needs to be adjusted for any known factors that will affect future sales.

An accurate sales forecast is critical. For example, if the market the company operates in expands more than the company expects it to, the company will be unprepared to meet the added demand and it will lose customers to its competitors. But if the company's forecasted sales are too high, then the company could end up with excess capacity and excess inventory, which in turn hurts cash flow. If the company has borrowed to expand in the expectation of higher sales and those higher sales do not materialize, then the company will be stuck with high interest charges on its debt in addition to unsold inventory and unused capacity. Therefore, management needs to use its best judgment about the future **along with** historical information and not simply rely on a forecast made using regression analysis or any of the other forecasting techniques.

### Forecasting Future Financing Needs

When a company's sales increase, the company will need additional funds. More inventory will be needed to support the increased sales. Accounts receivable will increase in proportion to the increase in sales. The company may need to purchase new equipment. The expected increases in assets can be funded in three ways.

- 1) When inventory increases, accounts payable will increase because more inventory is being purchased and/or manufactured. Accrued liabilities (such as accrued salaries and wages and accrued taxes) will also increase because of the increased activity. This increase in liabilities, called a **spontaneous liability increase**, will fund a portion of the increase in assets. These increases in liabilities are called spontaneous liability increases because they occur naturally.

**Note:** Borrowed funds, such as bank loans or bonds issued, are **not** liabilities that increase spontaneously. "Spontaneous" means produced without planning or without effort. The company needs to do something intentional to cause its borrowings to increase. For example, it might request a bank loan or issue bonds. Therefore, borrowed funds do not increase spontaneously.

- 2) Profits from additional sales will provide some of the funding. Any profits not paid out in dividends increase retained earnings. The additional retained earnings increase equity and provide a source of funds.
- 3) The remainder of the funding beyond what can be supplied by items 1 and 2 will need to be provided through external financing such as bank loans (short-term and/or long-term) or issuance of securities (stock or bonds).

The amount of external financing that will be required depends upon several factors:

- **The company's rate of sales growth.** Rapid sales growth generates increases in assets, and increases in assets generate the need for external financing. The **higher** the growth rate in sales, the **greater** will be the need for additional financing.
- **The company's capital intensity ratio, or the amount of assets required per dollar of sales.** The capital intensity ratio is **assets that increase when sales increase divided by sales revenue**, and it affects capital requirements. The **higher** the company's capital intensity ratio, the more assets it will require for a given increase in sales and thus it will have a **greater** need for external financing than a company with a lower capital intensity ratio. The capital intensity ratio is **not** total assets divided by sales revenue, because it may be that not all assets increase with increases in sales. The assets that increase when sales increase are specific to each business. For forecasting purposes, assets that **do not increase** with sales would be carried over to the forecast year with no increase, whereas the capital intensity ratio would be used along with forecasted sales to forecast the level of assets that **increase** with sales.
- **The company's spontaneous liabilities-to-sales ratio.** Companies that can finance more of their working capital needs by using accounts payable and accrued liabilities will have less need for external financing. Therefore, a higher ratio means less external financing will be needed, while a company with a **lower** ratio will have a **greater** need for external financing.
- **The company's net profit margin.** The higher a company's net profit margin is, the more increased net income will be available to fund increases in assets and the less need the company will have for external financing. The **lower** the net profit margin, the **greater** need the company will have for external financing.
- **The company's retention ratio.** The retention ratio is the amount of net income not paid out in dividends and retained in the company. Companies that pay out less of their net income in dividends will have more retained earnings and less need for external financing than companies that pay out more of their net income in dividends. Therefore, companies with **lower** retention ratios will have a **greater** need for external financing.

- **Planned changes in policies and procedures.** Such changes may have little or nothing to do with sales growth, or, like accounts receivable terms, they may affect sales growth. Examples of planned changes in policies and procedures might be plans to extend more- or less-liberal financing terms to customers or plans to change to a different major supplier that offers more or less favorable terms to the company. Both of these changes may affect the company's need for external financing.
  - More liberal financing terms extended to customers will increase sales and profits but will also create more uncollectible accounts and an increased level of accounts receivable. The net effect on the need for additional financing will depend on the balance between the increased profit from the increased sales, which will decrease the need for external financing, and the increase in accounts receivable because of the higher sales and longer payment terms, which will increase the need for external financing.
  - A change in a major supplier that requires payment to be made sooner may be coupled with a lower price. That net effect on the need for additional financing will also depend on the balance between the lower cost of the product, which would increase profits and decrease the need for external financing, and the need to make payment sooner, which would decrease the level of accounts payable and increase the need for external financing.

Medium-term forecasting covers periods of up to one year in the future, while long-term forecasting covers multiple years. The Forecasted Financial Statement method is a method of forecasting the additional funds needed that is well suited to medium- and long-term use. It is not the only forecasting method, but it is the most flexible method and the one covered on the exam.

Short-term cash forecasting covers periods of about 30 days into the future and is based on actual data (such as expected receipts from actual accounts receivable outstanding, expected payments of actual accounts payable, and so forth) rather than on projected data. This is not the type of cash forecasting discussed here.

### The Forecasted Financial Statement (FFS) Method

The Forecasted Financial Statement approach to forecasting future financing needs involves preparation of a complete set of pro forma financial statements, including income statement, balance sheet, and statement of cash flows. We begin with a forecast of sales and we forecast the assets (such as accounts receivable, inventory, and fixed assets) that will be needed to support those sales, the spontaneous liabilities (such as accounts payable and accruals) that will arise, and the increase in retained earnings from profits. All of the sources of financing are forecasted, including existing debt and equity. The forecasted increase in retained earnings is developed from the projected income statement and dividend payments. The difference between total assets and total liabilities plus equity is the "additional funds needed," which is a "plugged" figure on the balance sheet.

The FFS method produces a forecast of the entire balance sheet and income statement. The pro forma balance sheet and income statement can then be used to create the pro forma statement of cash flows.

### Steps in Forecasting Using the Forecasted Financial Statement Method (5 Steps)

**Step 1: Analyze historical ratios** that will be used for the projections. The ratios to be used will relate the various items to sales by dividing each one by sales. Look at the actual ratios for at least the past 5 years, the historical average over the same period, and the industry average (developed from financial statements for all firms in the industry) for the following ratios:

- Costs divided by sales (COGS divided by sales, SG&A divided by sales)
- Depreciation divided by net property, plant, and equipment
- Cash divided by sales
- Accounts receivable divided by sales
- Inventory divided by sales
- Net property, plant, and equipment divided by sales
- Accounts payable divided by sales
- Accruals divided by sales

Look for trends in the ratios and look at how the current ratios compare with their historical averages and determine the cause of differences. Any change from the historical trend that has occurred recently might be caused by temporary factors, and in the future the ratio might move back toward its average. Compare the ratios with the industry averages. Consider the effects of the economy on sales and look at what is happening in the industry within which the company operates to determine whether external factors might affect the ratios in the future. Consider any known operating plans of the company, such as a planned expansion. For example, if the company has been preparing for an expansion, its projected costs might need to be increased temporarily due to increased anticipated advertising costs.

**Example:** Here are historical ratios for ABC Industries. We will use only 2 years of history, although in practice 5 years should be used. All of these ratios relate the item to be forecasted to sales by dividing the historical level of the item by historical sales. These ratios are used specifically for forecasting balance sheet and income statement items based on forecasted sales, and therefore they are different from ratios that are used for financial statement analysis.

	Actual <u>20X0</u>	Actual <u>20X1</u>	Historical <u>Average</u>	Industry <u>Average</u>
COGS to sales	74.3%	75.5%	74.9%	72.5%
SG&A costs (excluding depreciation) to sales	17.3%	17.9%	17.6%	17.0%
Depreciation to net property, plant, & equip	9.7%	9.1%	9.4%	9.4%
Cash to sales	0.6%	0.4%	0.5%	0.9%
Accounts receivable to sales	10.9%	11.2%	11.1%	10.8%
Inventory to sales	10.5%	12.5%	11.5%	12.0%
Net property, plant, & equipment to sales	31.6%	32.3%	32.0%	33.5%
Accounts payable to sales	1.5%	2.4%	2.0%	1.5%
Accruals to sales	5.3%	5.9%	5.6%	4.5%

**Step 2: Forecast the income statement.** The income statement and the balance sheet need to be integrated, of course. The income statement is forecast first. Since net income flows to the balance sheet, forecasting the balance sheet will follow the income statement forecast. These steps will be demonstrated in the example that follows. They should be performed in this order.

- 1) **Forecast sales.** If management expects a 10% increase in sales for the current year, as in the example of ABC Industries above, forecasted sales will be the previous year's sales multiplied by 1.10. In the ABC Industries example, sales are forecasted to be  $\$150,000 \times 1.10$ , or  $\$165,000$ .
- 2) **Forecast Earnings Before Interest and Taxes (EBIT).** Take the actual income statement for the most recent year and adjust it using the historical ratios, where appropriate, to develop the forecast for the current year.
- 3) **Forecast net interest expense or net interest income.** Interest income and interest expense are combined into a net interest figure that is an adjustment to EBIT to calculate EBT. If interest expense is higher than interest income, the company will have net interest expense. Net interest expense is the sum of the company's daily interest charges on all of its loans (short-term and long-term) minus its daily interest income from short-term and long-term investments. If interest income is higher than interest expense, the company will have net interest income. Net interest income is interest income minus interest expense. (For most companies, interest will be a net expense, not a net income.)

The amount of interest expense used in this calculation depends on the outstanding loan balances and the interest rate on those loan balances. However, these loan balances will not be the same all year long. The outstanding loan balances could change daily. What outstanding loan balance should be used in calculating the interest expense on debt? There is more than one approach.

- a. One way is to use the loan balances expected at the **end** of the forecasted year. However, this approach would create a full year's interest charge on any new debt added during the year. A full year's interest charge would mean the new debt was expected to be in place at the very beginning of the year, which is unlikely and would overstate interest expense.

Another problem with this approach is called **financing feedback**. Increasing the amount of financing needed on the pro forma balance sheet causes interest expense on the pro forma income statement to increase. Increasing interest expense in turn requires another increase in the amount of financing required, which causes even higher interest expense, and so on in a never-ending cycle. Financing feedback can be dealt with in a spreadsheet, but doing so increases the complexity of the projections beyond what the benefits may justify.

- b. Another approach is to use the average of the forecasted debt at the beginning and the end of the year. If the debt were added evenly throughout the year, this would produce the correct interest expense. However, usually debt is not added evenly throughout the year. Furthermore, because the year-end debt level is used to calculate the average debt, the problem of financing feedback exists with this approach as well.
- c. A third method, which is used in the example that follows, works well in most situations and avoids the problem of financing feedback. The interest expense is based on the level of debt at the **beginning** of the year to be forecasted. The problem with this approach, of course, is that if the debt level increases during the year, which it no doubt will, the interest expense will be underestimated. This problem can be dealt with by calculating interest expense using a forecasted interest rate that is approximately 0.5% higher than the interest rate actually expected.

**Exam Tip:** If you follow this third approach on an essay exam question, **make sure you note in your answer** that to avoid the problem of financing feedback you have based forecasted interest expense on the outstanding loan balances as of the beginning of the year and added 0.5% to the interest rate.

Different loans have different interest rates. For this forecast, we will use just two rates: one for short-term borrowings and one for long-term borrowings. The rate to use for short-term borrowings should be the present rate increased by 0.5%. For long-term debt, we use an average of the rates on the current outstanding long-term borrowings and the rate that is expected on any new long-term debt increased by 0.5%. The forecasted interest expense will be the net forecasted interest expense on short-term financing plus the forecasted interest expense on long-term bonds.

- 4) **Complete the income statement.** Net interest expense (interest expense minus interest income) is subtracted from EBIT to calculate EBT. If interest income is greater than interest expense, net interest income (interest income minus interest expense) is added to EBIT to calculate EBT. We then subtract tax at a given rate to calculate net income before preferred dividends; we then subtract preferred dividends to calculate net income available to common shareholders.

**Example:** Here are ABC Industries' 20X1 actual and 20X2 forecasted income statements (000 omitted). The 20X2 forecasts make use of the historical ratios for ABC calculated a few pages previously.

	<u>Actual 20X1</u>	<u>Forecast Based On</u>	<u>Forecast 20X2</u>
Net Sales (all on credit)	\$150,000	20X1 net sales $\times$ 1.10	\$165,000
COGS (including depreciation)	<u>113,210</u> <sup>1</sup>	20X2 forecasted net sales $\times$ 0.755	<u>124,575</u> <sup>1</sup>
Gross profit	\$ 36,790		\$ 40,425
SG&A exp. excluding deprec.	26,880	20X2 forecasted net sales $\times$ 0.179	29,535
Depreciation exp.-SG&A only	<u>409</u> <sup>1</sup>	See Footnote 1	<u>446</u> <sup>1</sup>
EBIT	\$ 9,501		\$ 10,444
Less: Net interest	<u>1,579</u> <sup>2</sup>	See Footnote 2	<u>1,706</u>
Earnings before taxes (EBT)	\$ 7,922		\$ 8,738
Taxes at 40%	<u>3,169</u>		<u>3,495</u>
Net income	\$ 4,753		\$ 5,243

<sup>1</sup> Net property, plant, and equipment equaled 32.3% of net sales in 20X1, and total depreciation equaled 9.1% of net plant and equipment in 20X1, or \$4,409 in total. A portion of the depreciation on manufacturing facilities is included in cost of goods sold expense and another portion is capitalized in inventory. Under absorption costing, fixed manufacturing costs (including depreciation on manufacturing facilities) are inventoried as part of the cost of each product and become a part of COGS when the units they are attached to are sold. Thus, 20X1 COGS includes \$3,160 in depreciation expense and \$840 in depreciation is capitalized in unsold inventory. SG&A depreciation is the only portion of the total depreciation that is segregated on the income statement (\$409). These three items sum to total 20X1 depreciation of \$4,409. **This information about total 20X1 depreciation and its breakdown comes from the Notes to the Financial Statements for 20X1 and is not something that can be calculated from information given here.** The forecast for net property, plant, and equipment for 20X2 is forecasted 20X2 net sales of \$165,000  $\times$  0.323, or \$53,295; the forecast for total depreciation for 20X2 is \$53,295  $\times$  0.091, or \$4,850. The 20X2 forecasted depreciation is prorated among COGS, inventory, and SG&A based on the allocation of the 20X1 actual depreciation. In 20X1, depreciation expensed in COGS represented 71.7% of the \$4,409 in total depreciation, depreciation capitalized in inventory represented 19.1%, and depreciation expensed in SG&A represented 9.2% of total depreciation. Therefore, \$3,478 (71.7%) of the forecasted 20X2 depreciation is included in COGS expense, \$926 or 19.1% is capitalized in inventory, and \$446 or 9.2% is expensed in SG&A.

<sup>2</sup> Short-term loan balance at the end of 20X1/beginning of 20X2 is \$10,000 and the expected average interest rate on short-term borrowings is 5%. Long-term loan balance at the end of 20X1/beginning of 20X2 is \$15,410 and the expected average interest rate on long-term borrowings is 7%. Interest rates have been increased by 0.5% to reflect increased borrowing levels expected throughout the year. Therefore, the forecasted interest is 5.5% on short-term borrowings of \$10,000 plus 7.5% on long-term borrowings of \$15,410.  $(\$10,000 \times 0.055) + (\$15,410 \times 0.075) = \$1,706$ .



**Step 4: Forecast the Balance Sheet.** Here are the steps to follow:

- 1) **Forecast operating assets.** We will use the 20X1 actual ratios for current assets. The 20X1 ratio of cash to net sales was 0.4%, accounts receivable to net sales was 11.2%, and inventory to net sales was 12.5%. However, the amount of net property, plant, and equipment may or may not be proportional to net sales. A manufacturer's fixed assets will stay at a given level as long as production and net sales remain within the relevant range, and then they will increase all at once. On the other hand, a retail store chain grows by opening new stores, and for that business fixed assets will increase more in proportion to net sales. In the long term, all costs are variable costs. Thus in the long run, there will be a strong relationship between net sales and fixed assets for all companies. For short-term forecasting, companies usually use planned investment in plant and equipment. Since information on planned investment may not be available for a medium or long-term forecast, it is reasonable to assume a constant ratio of net plant and equipment to sales. For ABC, we will use the 20X1 ratio of net plant and equipment to net sales.
- 2) **Forecast operating current liabilities.** Increased net sales will require increased purchases of raw materials, which will lead to higher accounts payable. The most recent ratio of accounts payable to net sales is used to forecast the level of accounts payable. In addition, higher net sales will create a need for more direct manufacturing labor, so accrued wages will increase. Higher sales will result in higher taxable income for the company, so accrued taxes will also increase. These ratios for the most recent year will be used to forecast the 20X2 levels.
- 3) **Forecast items determined by policy decisions.** The remaining liability and equity items depend on the company's financial policies. We will assume the following policies: No additional common or preferred stock will be issued, dividends will be increased at a rate of 4% per year, and no new bonds will be issued. Short-term notes payable will be used for new financing requirements, since the company has a line of credit that it can use. We will therefore assume that long-term debt and equity will be the same during the year as they were at the end of the previous year. Temporarily, we will use the same balance for short-term notes payable as was outstanding last year. However, since short-term notes payable will be used for new financing requirements, short-term notes payable will be adjusted after everything else is complete, so it is subject to change.



**Example:** Here are ABC Industries' actual 20X1 balance sheet and forecasted 20X2 balance sheet (000 omitted). The Notes Payable line has been adjusted to make the balance sheet balance.

	Actual 20X1	Forecast Based On	Forecast 20X2
<b>Assets</b>			
Cash & Cash Equivalents	\$ 600	20X2 forecasted net sales $\times$ 0.004	\$ 660
Short-term investments	0	If extra funds, use as plug	0
Accounts receivable	16,800	20X2 forecasted net sales $\times$ 0.112	18,480
Inventories (incl. \$840 of depr.)	<u>18,800</u> <sup>1</sup>	20X2 forecasted net sales $\times$ 0.125	<u>20,625</u>
Total current assets	\$ 36,200		\$ 39,765
Net property, plant, and equip	<u>48,450</u> <sup>2</sup>	20X2 forecasted net sales $\times$ 0.323	<u>53,295</u>
Total assets	\$ 84,650		\$ 93,060
<b>Liabilities and Equity</b>			
Accounts payable	\$ 3,600	20X2 forecasted net sales $\times$ 0.024	\$ 3,960
Accrued liabilities	8,850	20X2 forecasted net sales $\times$ 0.059	9,735
Notes payable	<u>10,000</u>	20X1 bal. of \$10,000 + adjustment	<u>14,618</u> <sup>3</sup>
Total current liabilities	\$ 22,450		\$ 28,313
Long-term debt	<u>15,410</u>	20X1 bal. of \$15,410 (no change)	<u>15,410</u>
Total liabilities	\$ 37,860		\$ 43,723
Preferred stock	\$ 4,000	20X1 bal. of \$4,000 (no change)	\$ 4,000
Common stock	\$ 1,920	1,920,000 shs., par value \$1, no change	\$ 1,920
Additional paid-in capital	13,000	No change	13,000
Retained earnings	<u>27,870</u>	20X1 RE + \$2,547 addition to RE	<u>30,417</u> <sup>4</sup>
Total common equity	<u>\$ 42,790</u>		<u>\$ 45,337</u>
Total equity	\$ 46,790		\$ 49,337
Total liabilities and equity	\$ 84,650		\$ 93,060
Required assets			\$ 93,060 <sup>5</sup>
Specified sources of financing			<u>88,442</u> <sup>6</sup>
<b>Additional funds needed</b>			<b><u>\$ 4,618</u></b>
Required additional notes payable			\$ 4,618
Additional short-term investments			0

If the specified sources of financing had been **greater** than the required assets instead of less than the required assets, then ABC would not need any additional financing and would have excess funds available to invest.

<sup>1</sup> A portion of the depreciation on manufacturing facilities is capitalized in inventory and another portion is included in cost of goods sold expense. Under absorption costing, fixed manufacturing costs (including depreciation on manufacturing facilities) are inventoried as part of the cost of each product and become a part of COGS when the units they are attached to are sold.

<sup>2</sup> "Net" property, plant, and equipment means net of accumulated depreciation.

<sup>3</sup> Notes payable has been adjusted to increase its 20X1 ending balance of \$10,000 by the \$4,618 of additional funds needed to \$14,618.

<sup>4</sup> The \$2,547 addition to retained earnings in the forecast comes from the forecasted income statement. It is \$5,243 net income minus \$200 preferred dividends minus \$2,496 common dividends.

<sup>5</sup> Required assets are all of the forecasted operating assets (\$93,060) plus short-term investment balance (0) for the previous year.

<sup>6</sup> Specified sources of financing include the forecasted operating current liabilities (accounts payable and accruals only, \$13,695), forecasted long-term debt (\$15,410), forecasted preferred stock (\$4,000), forecasted common equity (\$45,337), and notes payable for the previous year (\$10,000).

Identifying the amount of additional funds that will be needed is one of the most important uses of pro forma financial statements. If financial managers know how much funding they expect to need, they can make arrangements to obtain the financing before the need becomes critical. In the example above, the need is not great and the company can obtain the funds by borrowing them on a short-term basis. If the amount needed is large, though, the company may decide to issue new stock or a new bond.

**Step 5: Construct a pro forma statement of cash flows.** Once the pro forma income statement and pro forma balance sheet are complete, a pro forma statement of cash flows can be constructed in the same manner as a statement of cash flows is constructed for actual results using the actual income statement and actual balance sheet. We have constructed a pro forma statement of cash flows using the indirect method of presenting cash flows from operating activities using the 20X1 actual and 20X2 pro forma balance sheets and the 20X2 pro forma income statement for ABC Industries. **Make sure you understand where all of the amounts on the following statement of cash flows come from.** Preparation of an indirect statement of cash flows is covered in this book in Section A, *Financial Statements*.

**The following Statements of Cash Flows should not be used to learn how to develop a cash flow statement. They are not adequate for that purpose because they do not have enough explanation. If you have questions, please see the explanation of how to prepare a statement of cash flows in this book in Section A, *Financial Statements*.**

**Here is the pro forma indirect Statement of Cash Flows for 20X2 for ABC Industries:****Cash Flows from Operating Activities:**

Net income	\$ 5,243	
Add/(deduct) items not affecting cash:		
Increase in accounts receivable	(1,680)	
Increase in inventories	( 899)	
(Ending inventory <b>excluding</b> depr. \$19,699 minus beginning inventory <b>including</b> depr. \$18,800) <sup>1</sup>		
Depreciation expensed	3,924 <sup>2</sup>	
Increase in accounts payable	360	
Increase in accrued liabilities	<u>885</u>	
Net cash flows from operating activities		\$7,833

**Cash Flows from Investing Activities:**

Purchase of equipment	( <u>9,695</u> ) <sup>3</sup>	
Net cash used in investing activities		( 9,695)

**Cash Flows from Financing Activities:**

Dividends paid	( 2,696)	
(Common dividends \$2,496 plus Preferred dividends \$200)		
Increase in notes payable	<u>4,618</u>	
Net cash flows provided by financing activities		<u>1,922</u>
Net increase in cash and cash equivalents		\$ 60
Cash and cash equivalents at beginning of year		<u>600</u>
Cash and cash equivalents at end of year		\$ 660

<sup>1</sup> We are frequently asked why beginning inventory includes depreciation but ending inventory excludes it. In the Statement of Cash Flows, we measure changes in cash that have taken place from the end of one year to the end of the next year. Any transactions that affected inventory or any other accounts during any year previous to the year under consideration are not relevant. Since the depreciation included in beginning inventory was a noncash transaction that occurred during the prior year, it is not relevant to calculating net cash flow for 20X2. Thus, we need to deduct 20X2 depreciation from 20X2 ending inventory, but we do not deduct 20X1 depreciation from 20X1 ending inventory (and 20X1 ending inventory is 20X2 beginning inventory).

<sup>2</sup> Depreciation expensed of \$3,924 includes \$3,478 of the forecasted 20X2 depreciation that is included in COGS expense plus \$446 of SG&A depreciation that is expensed. Depreciation still capitalized in inventory has not yet been expensed and therefore is not added back to net income here. See the pro forma income statement, Note 1, for details.

<sup>3</sup> Beginning Net PP&E + Purchases – Current Depreciation = Ending Net PP&E.  
 48,450 + Purchases – 4,850 = 53,295  
 Purchases = 9,695

**Summary of Forecasting Using the Forecasted Financial Statement Method**

- 1) Analyze historical ratios
- 2) Forecast the income statement
- 3) Forecast the Balance Sheet
- 4) Construct a pro forma Statement of Cash Flows

**Analysis of Pro Forma Financial Statements**

Developing the forecasted financial statements is only the beginning of the top-level planning process. The pro forma financial statements need to be analyzed to determine whether the firm's forecasted financial situation meets the firm's targets. If it does not, then changes will be needed, not just to the forecast but also to the operating plans that resulted in the forecast, and the pro forma statements will need to be revised.

Ratio analysis is used to compare the firm's actual ratios and projected ratios with target ratios as well as the latest industry average ratios. Ratio analysis is covered in detail on the CMA Part 2 exam, but you will need to be somewhat familiar with it for this exam in order to analyze the ratios in the pro forma financial statements.

The following ratios will be used in analyzing ABC's pro forma financial statements. Although average balances for balance sheet items are preferable for financial statement analysis when relating an income item to a balance sheet item, if averages are not available then it is acceptable to use ending balances. For this purpose, we will be comparing ratios for year-end 20X1 with ratios for forecasted year-end 20X2 and 20X1 year-end industry averages. Since averages are not available for the industry, we will use all year-end balances to be consistent.

<b>Current ratio:</b>	<b>Total current assets / Total current liabilities</b>
<b>Inventory turnover:</b>	<b>Annual cost of sales / Inventory</b>
<b>Days sales in inventory:</b>	<b>365 / Inventory turnover or Inventory / (Cost of goods sold / 365)</b>
<b>Accounts receivable turnover:</b>	<b>Annual net credit sales / Accounts receivable</b>
<b>Days sales in receivables:</b>	<b>365 / Accounts receivable turnover or Accounts receivable / (Annual net credit sales / 365)</b>
<b>Interest coverage ratio:</b>	<b>EBIT / Interest expense</b>
<b>Asset turnover:</b>	<b>Net sales / Total assets</b>
<b>Debt to equity ratio:</b>	<b>Total liabilities / Total equity</b>
<b>Gross profit margin:</b>	<b>Gross profit / Net sales</b>
<b>Net profit margin:</b>	<b>Net income<sup>1</sup> / Net sales</b>
<b>Return on assets:</b>	<b>Net income<sup>1</sup> / Total assets</b>
<b>Return on equity:</b>	<b>Net income<sup>1</sup> / Total equity</b>

<sup>1</sup> Net income = Net income before preferred dividends are subtracted to calculate income available to common shareholders.

Here are the key ratios for ABC. You should recalculate these ratios so that you understand them.

	Actual <u>20X1</u>	Forecast <u>20X2</u>	Industry Average <u>20X1</u>
Current ratio	1.6 to 1	1.4 to 1	2.0 to 1
Inventory turnover	6.0 times	6.0 times	5.5 times
Days sales in inventory	60.8 days	60.8 days	66.4 days
Accounts receivable turnover	8.9 times	8.9 times	8.0 times
Days sales in receivables	41.0 days	41.0 days	45.6 days
Interest coverage ratio	6.0 to 1	6.1 to 1	7.2 to 1
Asset turnover	1.8 times	1.8 times	1.9 times
Debt to equity ratio	80.9%	88.6%	75.0%
Gross profit margin	24.5%	24.5%	30.7%
Net profit margin	3.2%	3.2%	4.5%
Return on assets	5.6%	5.6%	8.5%
Return on equity	10.2%	10.6%	12.0%

With the exception of the debt to equity ratio, the ratios for forecasted 20X2 are very similar to the ratios for actual 20X1 because we used the 20X1 ratios between the various items and sales as models for the 20X2 forecast. The debt to equity ratio is higher in the 20X2 forecasted financial statements than in the 20X1 actual statements because the 20X2 forecast reflects the anticipated borrowing need.

The first step in the analysis is to compare the 20X2 forecasted ratios to the industry averages. ABC's ratios are a little better than the industry averages for inventory and receivables turnover but worse than the industry averages for everything else.

After comparing the company's forecasted ratios to the industry averages, the next step is to analyze the actual and pro forma financial statements to determine the causes of the negative variances from the industry averages. ABC's debt to equity ratio is higher than the industry average, which means its interest expense is also higher than that of its peers. Furthermore, a considerable amount of the debt is short-term, which is causing its current ratio to be lower than the industry average.

ABC's gross profit margin, net profit margin, return on assets, and return on equity are all much lower than industry averages. The lower return on assets and return on equity indicate that ABC is earning less net income for each dollar invested in assets and for each dollar of its equity than other companies in the same industry. The lower gross profit margin indicates the amount of gross profit it is earning on each dollar of sales is also lower than that of its peers in the industry, which in turn means ABC's cost of goods sold is higher than that of its peers.

As a result of this analysis, ABC is looking at its cost of sales to determine if it is experiencing waste in the production process. It is also studying the profitability analyses by product line to determine whether some of the less profitable product lines should be discontinued or changed. If the company can improve its profitability, it should be able to pay down some of its debt and lower its interest expense.

After the company makes its decisions about operational changes to be made, it will revise the pro forma statements for 20X2 and recalculate the ratios to see whether the changes will create enough improvement in the ratios to enable the company to reach its targets. If the revised ratios are satisfactory, ABC will pursue those operational changes. If the revised ratios are still not satisfactory, the company will reconsider what else needs to be changed in its operations in order to achieve its objectives.

After the pro forma financial statements have been revised and the operational changes have been made, the company's management will need to evaluate its actual results against the pro forma statement to determine whether its objectives have been met. The primary method of making this determination will be a comparison of the actual ratios and the pro forma ratios.

We do not show the revised pro forma financial statements or the revised ratios here.

**Other Uses of Pro Forma Financial Statements**

Pro forma financial statements can also be used to evaluate the company's dividend policy. ABC Industries has had a policy of increasing its dividend on its common stock every year, and it has projected a 4% increase in its dividend for 20X2. However, if the company were to reduce the growth rate of the dividend, additional funds would be available to invest in plant, equipment, or inventories; to use to reduce borrowings; or possibly to use to repurchase its stock.

## Section C – Performance Management

Performance Management represents 20% of the CMA Part 1 exam. Part 1 is a four-hour exam containing 100 multiple-choice questions and two essay questions. Topics within an examination part and the subject areas within topics may be combined in individual questions. Therefore, we can neither predict how many multiple-choice questions you may get from this section, nor can we predict whether or not you will get any essay questions from this section. The best approach to preparing for this exam is to know and understand the concepts well and be ready for anything.

The majority of the mathematical questions will come from the variance analysis and performance measures parts of this section. A number of variances are covered, and you will need to know how to calculate them, what they mean, and who can affect them. While the variance topic may seem large and overwhelming at first, when it is broken down into its individual elements it will become easier.

The performance measurement portions focus on Return on Investment (ROI) and Residual Income (RI). For these measurements you need to know what they are, how they are calculated, and how they are used. You also need to be able to identify the weaknesses that are inherent in each measurement.

In addition to variance analysis and performance measurement, this section covers a few other topics.

Responsibility accounting is the breaking down of costs into those costs that can be controlled by the manager and those that cannot be controlled by the manager. There are a number of different cost classifications in this topic that you need to be aware of.

Transfer pricing is a topic that you need to know from both a theoretical standpoint and a numerical standpoint. The questions may require you to understand the issues that a company faces in establishing the transfer price as well as be able to calculate an acceptable transfer price under certain situations.

The final topic covered in this section is the balanced scorecard, which focuses on both financial and nonfinancial measures. You need to understand how the balanced scorecard works and its application.

## Cost and Variance Measures

Variance analysis is the process of comparing the actual expenses and revenues during a certain period to the budgeted amounts for that same period. With variance analysis we are able to determine the reasons why our actual results were different from the budgeted amounts. Knowing the reasons will enable us to focus our efforts on the areas that have been operating less efficiently than planned.

We introduced standard costs in the Budgeting section. Before getting into the process of variance analysis, we need to look at standard costs again and the role they play in the accounting and costing system.

A **standard cost** is an estimate of the cost the company expects to incur in the production process. Without a standard cost, the analysis of actual activities and results is very difficult because the company has no target (or standard) against which to measure its performance.

This standard cost is calculated prior to the **beginning of each period** and it is **based on the estimated costs** and the **expected level of activity** or production. As discussed in the Budgeting section, standard costs are determined through the use of accounting and production estimates. They are not simply created by management.

The comparison of actual costs to these standard costs allows the company to analyze its actual costs and also enables the company to undertake some **cost controls**. A large variance between the actual cost and the standard cost alerts management that something may be wrong and may need attention.

A standard cost is not the same as a standard cost system. A **standard cost** prescribes expected performance in terms of the expected cost of an item. A **standard cost system** is an accounting system that uses standard costs and standard cost variances **in the formal accounting system**. There are other types of accounting systems, and standard costs can be used with those systems as well. In those other types of accounting systems, the standard costs are used for control purposes **outside the formal accounting system**. The emphasis in this section, though, will be on standard cost systems that operate within the formal accounting system.

### Using a Standard Cost System

A standard cost system may be used with either a process costing system or a job-order costing system. A **process costing system** is used to assign costs to individual products when the products are all relatively similar and are mass-produced, as on an assembly line. **Job-order costing** is a method in which all of the costs associated with a specific job (or client) are accumulated and charged to that job (or client). Both process costing and job order costing are covered in more detail later.

Here are three reasons for adopting a standard cost system:

- 1) It is usually simpler to use standard costs in a process costing system because of the repetitive nature of the operation.
- 2) Use of standard costs in a process cost system makes it much easier to determine cost per equivalent unit. The standard costs serve as the cost per equivalent unit for direct materials, direct labor, and manufacturing overhead.
- 3) Use of standard costs simplifies recordkeeping in either a process costing system or a job-order costing system. Records need to be kept for quantities on hand. The cost associated with those quantities is simply the standard cost for the period.

Standard costs are best used **with a flexible budgeting system**. A flexible budgeting system provides the most useful variance analysis. The flexible budget will enable the company to identify differences from the budget that are not simply due to the actual quantity produced or sold being different from the budgeted quantity.



**Note:** A flexible budget is a budget that is prepared using the standard costs per unit produced and the actual level of activity (sales or production, as appropriate). The flexible budget is essentially what the budget would have been if the company had known what the actual level of sales or production would be in advance and had used that information when it developed the budget. Flexible budgets are covered in much more detail in Section B of this book.

## Determining the Level of Activity for Standard Costs

Costs are the result of activities that are undertaken to create products or render services. These activities are called **cost drivers**. Therefore, managers should focus on managing the activities rather than the costs. Standards should be established for the use of the activities that are the cost drivers underlying the costs. For example, a company needs to know how many direct labor hours will be needed during the period, and in order to determine this there must be a standard number of direct labor hours that is needed to produce one unit.

Using the correct level of production or activity is important when setting standard costs. If the standard level of activity is set too high, the workers will have no motivation because they know that, no matter how hard they work, they will fail to meet the budgeted level of output. The **ideal** (also called **perfect**, or **theoretical**) **level of output** assumes that there will be no breakdowns, no waste, no time lost to illness, and that the workers are working at maximum efficiency. While this maximum output may be achieved for short periods of time, this level of output is not realistic in the long run.

An alternative to this theoretical level of output is the **practical** (also called **currently attainable**) **level of output**. The practical level of output is the level that will be achieved given the normal amount of time lost, normal amount of waste, and a normal learning curve for employees. The goal is to use a level that is attainable but difficult to achieve. Such a level will motivate the workers while at the same time requiring them to work diligently.

In practice, however, either the **normal level of output** or the **master budget level of output** is used to set the standards. **Normal level** is an average expected level of production within the time frame of several years (up to three) given the reasonable expectations of effective and efficient production and customer demand. **Master budget** capacity is the planned capacity for the next budget period.

In addition to setting the correct level of output, the standard cost also **needs to be reviewed**. Just because the standard cost was \$X per unit last year does not mean that this figure is still a reasonable standard cost. Prices may change, the amount of material (or other activity) required may change, or the production process may change. All of these fluctuations may require that the standard cost be adjusted.

## Sources of Standards

Several sources can be used to set appropriate standards for usage and prices. These sources can include activity analysis, historical data, benchmarking, target costing, and strategic decisions.

**Activity analysis** involves identifying, delineating or outlining, and evaluating all the activities necessary to complete a job, a project, or an operation. An activity analysis considers everything required to complete a task efficiently and involves personnel from several areas, including engineers, management accountants, and production workers. Product engineers specify product components. Industrial engineers analyze the steps or procedures necessary to complete the task. Management accountants work with the engineers to complete the analysis. Activity analysis is time-consuming and expensive. However, if properly executed, activity analysis is the most precise way to determine standard costs.

Use of **historical data** is a less costly way to develop standard costs. If reliable information is available, then historical data for a similar product can be a good source for determining the standard cost of an operation. Another advantage to using historical data is that it is based on the way the particular firm has operated in the past. However, basing a standard on the past can perpetuate past inefficiencies, which is a disadvantage.

Although historical standards are more attainable than ideal standards, they are not consistent with a philosophy of continuous improvement.

**Benchmarking** to develop standard costs is based on using current practices of similar operations in other firms. Associations of manufacturers often collect industry information and have data available. The firm can use this data as guidelines for setting standard costs. In using benchmarking to set standard costs, a firm makes use of information about the best performance anywhere. Achieving equivalent performance can help the firm sustain its competitive edge. A disadvantage of benchmarking is that it might not be completely applicable to the firm's own situation.

Using **target costing** to set standard costs puts the focus on the market and on the price the product can be sold for. A **target price** is the price the firm can sell its product for, and the **target cost** is the cost that must be attained for the firm to realize its desired profit margin for the product. Once the target cost has been determined, detailed standards are then set to attain the desired cost.

Target costing utilizes the concept of **kaizen**, the Japanese term for continuous improvement, to reduce costs to what is necessary in order to earn the desired profit margin. This reduction of cost is accomplished by developing new manufacturing methods and techniques. Development of new methods and techniques entails an ongoing search for new ways to reduce costs, resulting in continuous improvement, which is the heart of the *kaizen* concept.

Additionally, **strategic decisions** may affect a product's standard cost. For example, a decision to replace an obsolete machine with a new, computer-controlled machine would require an adjustment to the standard cost and machine hours for the process. A commitment to strive for *kaizen* is another example, as that commitment might require standards to be set at a level that would provide the maximum challenge.

Question 109: Which one of the following is least likely to be involved in establishing standard costs for evaluation purposes?

- a) Budgetary accountants.
- b) Industrial engineers.
- c) Top management.
- d) Quality control personnel.

(CMA Adapted)

Question 110: A firm most often uses a standard costing system in conjunction with:

- a) Management by objectives.
- b) Target (hurdle) rates of return.
- c) Participative management programs.
- d) Flexible budgets.

(CMA Adapted)

## Variance Analysis Concepts

Before looking at the individual variances that are related to the price and usage of labor and materials, we will start with some general variance concepts.

In general, variances are a comparison between the budgeted results of the company and the actual results of the company. Variances are calculated for various **levels**, some containing more detail than others. The greater the detail provided by the variance, the greater the information the variance provides about the cause of the variance. In manufacturing variances, which this topic focuses on, the detailed causes of the variances provide information about whether or not the actual quantity of inputs was different from the budgeted quantity and whether or not the actual price per unit of inputs was different from the budgeted price.

Because of the nature of variances, all of the calculations we make will be comparisons between an actual amount and a budgeted amount. What we are specifically comparing will depend on the variance that we need to calculate.

**Note:** In this section, the terms “budget” and “standard” are used interchangeably and mean the same thing: a planned amount.

### “Levels” in Variance Analysis

Variances can be classified in terms of level. A level denotes the amount of detail that is provided by the variance. A low-level variance provides the least detail, whereas more information is provided by a variance with a higher level number.

It is not important to memorize the various level numbers and which variances are included in each. It is important, though, to recognize that these levels express relationships between and among variances. Each successively higher level of variance analysis breaks the previous level’s variance down into more detail and thus represents a deeper level of analysis that provides more insight into the causes of the lower level variance.

### Static Budget Variances vs. Flexible Budget Variances

A **static budget** is a **fixed budget**. It is a budget that is prepared for one specific level of planned activity, and that level of planned activity does not change, no matter what the actual activity is. A static budget is easy to prepare, but it is not very useful for control and evaluation purposes if the actual activity level (such as sales or production) is different from what had been planned. For instance, a cost may be higher in total than budgeted, but if sales were also higher than expected, the portion of the variance that is due to the increased sales is to be expected and is not a cause for concern. Variances that result from comparing total actual cost to the fixed budgeted cost are Level 1 variances. These low-level variances are less useful than higher-level variances because low-level variances give no information about the cause or causes of the variance.

A more useful and usable budget is a **flexible budget**. This is a budget in which budgeted variable revenues and costs have been adjusted to the total revenue or cost that would be anticipated for the actual level of activity that has occurred. Normally, fixed costs in the flexible budget are the same as fixed costs in the static budget. Budgeted fixed costs in the flexible budget are adjusted only if the actual activity level is outside the relevant range.

Flexible budget variances are a better indicator of operating performance than static budget variances because they compare **actual results** to the **budgeted results adjusted for the actual volume**. If an actual cost is higher than its flexible budget amount, then that variance may be cause for concern. Flexible budget variances are Level 2 variances and are more useful for management decision-making.

The highest level of variances, Level 3 variances, are variances calculated for a single manufacturing input (for example, direct material, direct labor, or variable overhead). These are the most detailed and provide the most specific information for management to work with.

### Level 1 Variances: Static Budget Variances

**Level 1 variances** are the most global variances. Static budget variances are Level 1 variances; therefore, static budget variances are the most global. They are based on the income statement and merely compare the actual results with the static (master) budget. Since they are based on the income statement, Level 1 variances report variances in revenue and cost of sales for sold units only. They do not report detailed cost variances for all units produced.

While these variances tell us whether we performed better or worse than expected, they do not provide any information as to **why** we performed better or worse than expected.

The primary **benefit** of measuring performance by comparing actual results with the master budget is that it provides a means for management to recognize the unexpected variances, thus pointing out which operating variances need to be investigated. Recognition of variances that need to be investigated is one of the most important steps in the budgeting process. Analysis of variances is part of the **control loop**. The **control loop** is the process by which the activities of the company are controlled.

Here are some **limitations** of measuring performance by comparing actual results with the master budget:

- Variances caused by more or fewer sales than planned are not segregated from variances caused by other factors.
- Comparison of actual with the master budget focuses on short-term performance instead of long-term success.
- Managers should be evaluated on performance measures other than just whether or not they have met short-term financial targets. Meeting financial targets is only part of the measurement of performance. Manager evaluation should include not only financial measures but also non-financial measures.

**Managers should be evaluated on their overall contribution to the achievement of the company's goals.** The financial contribution is part of the overall contribution, but it is not the full contribution. Evaluation of a manager's overall contribution can be accomplished by means of the balanced scorecard, which is discussed later in this section.

**Example:** Here is an example of a static budget variance report. This report is in income statement format, meaning it is based on revenue and cost of units **sold** rather than cost of units **produced**. (When we move into manufacturing input variance, variance reporting will be concerned with production input costs instead of the income statement.)

**Level 1 Variance Report:  
Static Budget Variances**

	<u>Col. 1</u>	<u>Col. 2</u>	<u>Col. 3</u> <b>(3) = (1) – (2)</b>
	<u>Actual Results</u>	<u>Static Budget</u>	<u>Static Budget Variance</u>
Units sold	20,000	24,000	4,000– U
Revenues	\$2,500,000	\$2,880,000	\$ 380,000– U
<i>Variable costs</i>			
Direct materials	1,243,200	1,440,000	196,800– F
Direct manufacturing labor	396,000	384,000	12,000+ U
Variable manufacturing overhead	<u>261,000</u>	<u>288,000</u>	<u>27,000–</u> F
Total variable costs	<u>\$1,900,200</u>	<u>\$2,112,000</u>	<u>\$ 211,800–</u> F
Contribution margin*	<u>\$ 599,800</u>	<u>\$ 768,000</u>	<u>\$ 168,200–</u> U
Fixed costs	<u>570,000</u>	<u>552,000</u>	<u>18,000+ U</u>
Operating income	<u>\$ 29,800</u>	<u>\$ 216,000</u>	<u>\$ 186,200– U</u>

\* "Contribution margin" is sales revenue minus variable costs of the sales.

When calculating variances, we always **subtract the budget amount from the actual amount** (Actual – Budget = Variance).

A **favorable variance** (represented with the letter F) is a variance that causes actual net operating income to be higher than the budgeted amount. An **unfavorable variance** (represented with the letter U) is a variance that causes actual net operating income to be lower than the budgeted amount.

Therefore, actual **revenue** that is below budgeted revenue, as is the case in the example, is a negative variance because actual is lower than budget ( $\$2,500,000 - \$2,880,000 = \$[380,000]$ ). That negative variance is **unfavorable** because it will cause actual net operating income to be **lower** than the budgeted amount.

On the other hand, actual **costs** that are below budgeted costs are also negative variances because the actual is lower than the budget, but they are **favorable** variances because they will cause actual net operating income to be **higher** than the budgeted amount. In the preceding example, actual direct material costs for the 20,000 units that were sold are \$1,243,200, while budgeted direct materials costs for the budgeted number of units to be sold are \$1,440,000. Actual cost of \$1,243,200 minus budgeted cost of \$1,440,000 equals \$(196,800), which is a favorable variance because the actual cost was lower than the budgeted cost.

If net operating income is to be increased, we want revenues to be **higher** than budgeted (a positive variance amount) and we want expensed costs to be **lower** than budgeted (a negative variance amount). Both of those variances are favorable variances.

**Note:** When calculating variances for incomes or costs/expenses, **always subtract the Budget amount from the Actual Amount** (as in the example above).

$$\text{Actual} - \text{Budget} = \text{Variance}$$

When the budget amount is subtracted from the actual amount, the sign of the variance will always follow these rules:

- A **positive** variance for an **income** item is a **Favorable** variance
- A **negative** variance for an **income** item is an **Unfavorable** variance
- A **positive** variance for a **cost or expense** item is an **Unfavorable** variance
- A **negative** variance for a **cost or expense** item is a **Favorable** variance

Note also in the example above that the Operating Income variance of \$(186,200) **cross foots**, meaning the amount is the same when calculated both across and down.

- Calculated going across: Actual Operating Income of \$29,800 minus Budgeted Operating Income of \$216,000 equals Operating Income variance of \$(186,200) Unfavorable.
- Calculated going down: The Revenue variance of \$(380,000) minus the Total Variable Costs variance of \$(211,800) equals the Contribution Margin variance of \$(168,200); and the Contribution Margin variance of \$(168,200) minus the Fixed Costs variance of \$18,000 equals the Operating Income variance of \$(186,200) Unfavorable, the same amount as was calculated going across.

In recalculating these amounts, be sure to use the +/- key on your calculator when entering negative numbers.

## Level 2 Variances: Flexible Budget Variances and Sales Volume Variances

Each of the static budget variances can be further broken down into two sub-variances: the flexible budget variance and the sales volume variance. These are **Level 2** variances, because they give us more information about the static budget variances. These variances are also in income statement format. Because they are based on the income statement and thus report on revenues and costs for items **sold**, these variances are also called **sales variances**. The term "sales variances" distinguishes them from manufacturing input variances, which are based on items **produced**.

- The **flexible budget variance** on a sales variance report is the difference between the actual results and the flexible budget.

$$\text{Actual Results} - \text{Flexible Budget Amount} = \text{Flexible Budget Variance}$$

The flexible budget is budgeted amounts that have been adjusted to the actual level of sales activity that has occurred. The flexible budget variance tells us how much of the static budget variance was caused by factors **other than** the difference between actual and budgeted sales volume. For example, the flexible budget variance on the revenue line indicates how much of the static budget variance was due to a difference between the actual price charged for each unit sold and the budgeted price per unit.

- The **sales volume variance** on a sales variance report is the difference between the flexible budget amount and the static budget amount.

$$\text{Flexible Budget Amount} - \text{Static Budget Amount} = \text{Sales Volume Variance}$$

The sales volume variance shows how much of the static budget variance was caused by actual sales volume being different from budgeted sales volume.

These variances may be calculated for operating income and for each line item on the income statement.

**Example:** Here is the example income statement again, this time showing the static budget variances, the flexible budget variances, and the sales volume variances for each line item and for net operating income.

For each line, the flexible budget variance plus the sales volume variance equals the total static budget variance. The calculation of the net operating income variances is shown at the bottom of the report. You should verify the variance calculations for the individual lines to make sure you understand how they are calculated.

**Level 2 Variance Report:  
Flexible Budget Variances**

	<u>Col. 1</u>	<u>Col. 2</u> (2)=(1)-(3)	<u>Col. 3</u>	<u>Col. 4</u> (4)=(3)-(5)	<u>Col. 5</u>	<u>Col. 6</u> (6)=(1)-(5) also (6)=(2)+(4) Static Budget Variances
	<u>Actual results</u>	<u>Flexible budget variances</u>	<u>Flexible budget</u>	<u>Sales volume variances</u>	<u>Static budget</u>	
Units sold	20,000	0	20,000	4,000– U	24,000	4,000– U
Revenues	\$2,500,000	\$100,000+ F	\$2,400,000	\$480,000– U	\$2,880,000	\$380,000– U
<i>Variable costs</i>						
Direct materials	1,243,200	43,200+ U	1,200,000	240,000– F	1,440,000	196,800– F
Direct manufacturing labor	396,000	76,000+ U	320,000	64,000– F	384,000	12,000+ U
Variable manufacturing overhead	<u>261,000</u>	<u>21,000+ U</u>	<u>240,000</u>	<u>48,000– F</u>	<u>288,000</u>	<u>27,000– F</u>
Total variable costs	<u>\$1,900,200</u>	<u>\$140,200+ U</u>	<u>\$1,760,000</u>	<u>\$352,000– F</u>	<u>\$2,112,000</u>	<u>\$211,800– F</u>
Contribution margin	<u>\$ 599,800</u>	<u>\$ 40,200– U</u>	<u>\$ 640,000</u>	<u>128,000– U</u>	<u>\$ 768,000</u>	<u>\$168,200– U</u>
Fixed costs	<u>570,000</u>	<u>18,000+ U</u>	<u>552,000</u>	<u>0</u>	<u>552,000</u>	<u>18,000+ U</u>
Operating income	<u>\$ 29,800</u>	<u>\$ 58,200– U</u>	<u>\$ 88,000</u>	<u>\$128,000– U</u>	<u>\$ 216,000</u>	<u>\$186,200– U</u>
		<b>\$58,200– U</b>		<b>\$128,000– U</b>		
		<b>Total flexible budget variance</b>		<b>Total sales volume variance</b>		
			<b>\$186,200– U</b>			
			<b>Total static budget variance</b>			

On the report above, the budgeted amounts for fixed costs are exactly the same in the flexible budget as they are in the static budget. Even though actual sales were lower than budgeted sales, sales remained within the relevant range. Therefore, budgeted fixed costs in the flexible budget are no different from budgeted fixed costs in the static budget. Both are \$552,000.



**Note:** On the Exam, you may be asked a question about a variance of any component of a budget. For example, you may be asked to calculate the variable costs flexible budget variance. To answer this question, calculate the difference between the actual and the flexible budget amounts of variable costs and determine whether the variance is favorable or unfavorable.

If a question does not say which line to use, use either the contribution margin line or the operating income line. If the question asks for the volume variance, the variances on the contribution margin line and the operating income lines will be exactly the same, so it does not matter which line you use. The variances on these two lines are the same because the volume variance is the difference between the static budget amount and the flexible budget amount. The only difference between the contribution margin line and the operating income line is fixed costs, and fixed costs are exactly the same in the flexible budget as they are in the static budget. Therefore, the volume variance for the contribution margin line will be exactly the same as the volume variance for the operating income line.

The detail variances that we will cover in the following pages give more information than can be obtained from just looking at a flexible budget variance report or a static budget variance report. The sales volume variance for a single-product firm like the one in the two example variance reports above can be explained by the fact that the actual level of sales was different from the budgeted level of sales. We do need to investigate the cause or causes of the sales volume variance, but we don't need any more variance detail to do that. A sales volume variance can be caused by the state of the economy, actions of competitors, production problems at the plant that prevented the company from manufacturing enough product to meet the demand, or any number of other things.

Flexible budget variances identify variances that are caused by something other than the different-than-expected sales volume. Flexible budget variances can be caused by multiple factors, and it is important to investigate what the factors are that caused them in order to determine what changes need to be made. Additional variance detail can be calculated to assist in this determination.

In a single-product firm, the flexible budget variance for revenue is fairly easy to investigate. A flexible budget variance for a revenue item is called a **selling price variance** because it is caused exclusively by differences between the actual selling price per unit and the budgeted selling price per unit. To investigate this variance, the company needs to find out why the price actually charged was different from the budgeted price. If the actual price was lower than the budgeted price per unit, the reason may be competitive pressure. If the actual price was higher than the budgeted price, the reason may be increased demand putting upward pressure on the price.

When a company sells more than one product, revenue variances can be caused by other factors as well as by different prices being charged than were budgeted. Variances can also arise when a different **mix** of products is sold than was budgeted. Further details are needed to determine the causes of variances for a multi-product firm. The company needs to determine how the product mix sold differed from the budgeted mix, which product or products were sold for prices that differed from their budgeted amounts, how the actual manufacturing costs compare with the budgeted costs for each product, how much contribution margin was lost or gained as a result of each difference, and why the actual sales volumes and prices were different from the budgeted volumes and prices.

Level 3 variances can give us more information about the causes of the variances.

### Sales Variances

1)	<b>Flexible budget variance</b>	}	<b>Level 2 variances</b>
2)	<b>Sales volume variance</b>		
2a)	<b>Quantity variance*</b>	}	<b>Level 3 variances</b>
2b)	<b>Mix variance*</b>		

\* These specific sales variances are calculated only when the company sells more than one product.

Level 3 variances also include manufacturing input variances. Manufacturing input variances will be covered first, followed by sales variances, sales quantity, and sales mix variances.



### Level 3 Variances: Manufacturing Input and Sales Quantity and Sales Mix Variances

Before examining the different individual variances in greater detail, we begin by listing the different variances to be studied. You need to know how to calculate each of these variances and understand what they mean. Additionally, you also must be able to identify possible causes of the different variances. The following are the variances that will be studied:

#### Manufacturing Input Variances:

##### Direct Materials Variances

- 1) **Price variance**
- 2) **Quantity or efficiency variance**
  - 2a) **Mix variance\***
  - 2b) **Yield variance\***

##### Direct Labor Variance

- 3) **Rate (price) variance**
- 4) **Efficiency (quantity) variance**
  - 4a) **Mix variance\***
  - 4b) **Yield variance\***

##### Factory Overhead Variances

- 5) **Total Variable overhead variance**
  - 5a) **Variable overhead spending variance**
  - 5b) **Variable overhead efficiency variance**
- 6) **Total Fixed overhead variance**
  - 6a) **Fixed overhead spending or budget variance**
  - 6b) **Fixed overhead production-volume variance**

##### Sales Variances

- 7) **Flexible budget variance**
  - 8) **Sales volume variance**
  - 8a) **Quantity variance\*\***
  - 8b) **Mix variance\*\***
- } **Level 2 variances**
- } **Level 3 variances**

\* These specific manufacturing variances are calculated only when there is more than one input (either classes of labor or types of material) into the final product.

\*\* These specific sales variances are calculated only when the company sells more than one product.

**Note:** The above list contains a lot of variances. However, the number of variances should not be a cause for discouragement. A number of these variances are simply variations on a theme. You do not need to memorize a separate formula for each variance.

## Manufacturing Input Variances

Manufacturing input variances are a special class of variances. They include direct materials, direct labor, and manufacturing overhead **used in production**. These variances are concerned with **inputs** to the manufacturing process, as follows:

- Whether the amount of inputs used per unit manufactured was over or under the standard (a quantity, or efficiency, variance),
- Whether the inputs used cost more or less per unit than the standard (a price variance), and
- What the monetary impact was of each type of variance.

Manufacturing input variances are used in controlling production. Manufacturing input variances are also called flexible budget variances, and the flexible budget amounts used are based on the price and quantity of the **input allowed for the actual production**. Manufacturing input variances are reported on a production variance report, not on a report in the form of an income statement, because they report on units produced, not on units sold.

In the accounting system, manufacturing input variances are closed out at the end of each period to cost of sales or, if material, they are prorated among cost of sales, finished goods inventory, work in process inventory and, for direct material variances only, direct materials inventory.

## The Difference Between Sales Variances and Production Variances

The variance reports seen so far have been sales variance reports, and they present only the results of units sold. Sales variances are Level 2 variances. In its variable manufacturing costs section, a Level 2 sales variance report presents the **total** flexible budget variance for variable manufacturing costs for units **sold**. This total flexible budget variance includes both the manufacturing input price and the manufacturing input quantity variances. They are presented on the report as one combined variance.

A production variance report, which is a Level 3 report, is required to present the detail behind the total flexible budget variance. However, a production variance report includes all units **produced**, whether they were sold or remained in inventory as unsold units at the end of the period.

Because a Level 2 sales variance report presents information on units sold and a Level 3 production variance report presents information on units produced, the two cannot be reconciled for a given reporting period unless the units that were sold are the same units as the units that were produced during the period. The total flexible budget variances for variable manufacturing costs on the Level 2 report cannot be broken down between manufacturing input price and quantity variances because the information needed to do that is not available.

Thus, Level 2 variances based on revenue and costs of units sold should not be expected to reconcile with the detail variances on a production variance report covering the same reporting period unless an exam question gives information that can be interpreted to mean that **the same units that were produced were the same units that were sold**.

For example, an exam question might say that the company is a new company that just started in business (thus beginning inventory was zero), and it sold all of its first period's production during its first period of operation. In that case, the company sold the same units as it produced. Other information given in the problem might also make it possible to reconcile the manufacturing input quantity variance and price variance on the production variance report to the total flexible budget variance on a sales variance report. But if the information given does not enable reconciliation, do not try to reconcile them, because it will not work.

## What Causes Manufacturing Input Variances?

Before we get into the specific manufacturing input variances, consider the possible reasons for an actual input cost to be different from the standard (that is, expected or budgeted) cost. The standard cost is determined using an **estimated cost** and an **estimated level of usage**. Obviously, if a company either pays a different price for an input than had been budgeted or uses a different amount of the input than was budgeted for the actual level of output, or both, then the actual cost for the actual level of output will be different from the budgeted cost for the actual level of output.

The simple fact that the actual cost was different from the budgeted amount is not, by itself, very useful information to management. Management needs to know **why** the actual cost was different from the budgeted amount.

- Was it because a different amount of raw materials or labor was used than should have been used for the actual output?
- Was it because a different price per unit was paid for the raw materials or labor?
- Was it because of differences in both? (This is the most likely scenario.)

The process of variance analysis enables management to identify the specific reason or reasons for the variance and then the company can focus its efforts on the areas that have a negative impact on the business.

In variance analysis, we subdivide input cost variances into their two causes:

- 1) A **price variance** that reflects the difference between actual and budgeted input prices.
- 2) A **quantity variance**, also called an **efficiency variance**, that reflects the difference between actual and budgeted input **quantities used**.

Variance analysis exam questions are not difficult if you can master a conceptual understanding of these two basic causes of variances.

## Summary of Manufacturing Input Variances

The following table summarizes the formulas and the terms used in variance analysis, and it is presented here as an overview of the material that will be covered in detail later. This table will appear again at the end of the topic of variances.

Prime Costs	Price Variance $(AP - SP) \times AQ$	Quantity Variance $(AQ - SQ) \times SP$
Materials	Price Variance	Quantity Variance
Labor	Rate Variance	Efficiency Variance

Multiple Inputs (both Material and Labor)	Mix Variance $(wasp_{AM} - wasp_{SM}) \times AQ$	Yield Variance $(AQ - SQ) \times wasp_{SM}$

Variable Overhead	Spending Variance $(AP - SP) \times AQ$	Efficiency Variance $(AQ - SQ) \times SP$
Fixed Overhead	Spending (Flexible Budget) Variance Actual OH – Budgeted OH	Production Volume Variance Budgeted OH – Applied OH

## Direct Materials Variances

We start by looking at the variances related to direct materials and their usage.

The **total direct material variance** is also the **flexible budget variance** for direct material. The total direct material variance is easy to calculate. It is the difference between the actual direct materials costs for the period and the standard costs for the standard amount of materials at the standard price per unit **for the level of output actually produced** (the flexible budget).

**Example:** Medina Co. produces footballs. Each football requires a standard of 1 square meter of leather that has a standard cost of \$5. During the period, Medina produced 250 footballs and used 290 square meters of leather. The actual cost of the leather was \$4.50 per square meter.

The total actual cost of the leather used was \$1,305 ( $290 \times \$4.50$ ). However, given the actual output of 250 footballs, Medina should have used only 250 square meters of leather. Since each square meter should have cost \$5, Medina should have spent \$1,250 on leather in order to produce 250 footballs ( $250 \times \$5$ ).

The total direct materials variance is:

Actual cost – 290 meters $\times$ \$4.50	\$ 1,305
Standard cost – 250 meters $\times$ \$5.00	\$ 1,250
Total variance	\$ <u>55</u> U

Medina spent more money than it should have for the leather to make the footballs. A manager might conclude that this situation is acceptable (it is an unfavorable variance, but it is not that large) and does not require any significant attention. However, a more in-depth examination reveals that the company used more materials than it should have but paid less for each square meter of leather than expected. Management will most certainly look at the production process to find out why so much leather was required to make 250 footballs.

Even though Medina's total actual cost came close to the total standard cost, there is a significant problem with production. The company may have a very inefficient process that wastes too much leather, or perhaps it has new workers who are not as experienced as they will be in the future. Perhaps the less expensive leather was more difficult to work with and therefore an excessive amount was spoiled in the production process. In any case, despite the total cost variance being small, Medina needs to investigate further the cause of the variance in its leather usage. This investigation of an unfavorable variance is an example of **management by exception**<sup>41</sup>.

Because of the need for more useful analysis, the total materials variance is divided into two components: price and quantity. The **quantity variance (also called the efficiency or usage variance)** measures how much of the variance is due to using more or less direct material than budgeted, and the **price variance** measures how much of the total variance was caused by having paid a different amount for the material than had been budgeted.

The **quantity variance** plus the **price variance** equals the **total variance**, which is also the **flexible budget variance**.

<sup>41</sup> "Management by exception" refers to a system whereby only significant variances between actual results and the budget or plan are brought to the attention of management. Management by exception focuses management on the things that have the highest priority, defined as the greatest variances.

**Note:** In a system where variances are identified and reported to the appropriate level of the company, management can **manage by exception** once the standards have been set. As a result, management can focus time in areas where there are problems identified by an unfavorable variance. While management by exception allows management to focus on areas that have problems, the disadvantage of this method is that negative trends may be overlooked at earlier stages. Also, if too many deviations from the budget occur, this approach can become a very confusing and complex process of trying to fix all the problems at once. Management would need to decide which variances are the most important.

Management should look into the departments and divisions that have favorable variances, too. It is possible that one of the departments has adopted a new policy or procedure that might be beneficial in other departments. By overlooking favorable variances, management might be missing the opportunity to implement positive changes throughout the company.

### The Quantity Variance

The **quantity variance** (also called the **efficiency** or **usage variance**) is calculated as:

$$\begin{aligned} & (\text{Actual Quantity} - \text{Standard Quantity for Actual Output}) \times \text{Standard Price} \\ & \text{or} \\ & \mathbf{(AQ - SQ) \times SP} \end{aligned}$$

This formula calculates the difference between the actual material usage and the standard usage for the level of actual output, multiplied by the standard price. The quantity variance formula is used to calculate the portion of the total variance that was caused by either too much or too little material having been used, without any reference to the amount of the variance that was caused by a difference between the actual and the standard price per unit of the material used. We multiply by the standard price in order to remove any effect of the price variance from the result.

Because this is a cost, a positive result in the formula is an unfavorable variance, while a negative result of the formula is a favorable variance.

In the example above, the **quantity variance** is calculated as:  
 $(290 - 250) \times \$5 = \$200$

This is an **unfavorable variance** because it is a positive variance for a cost. The \$200 variance means that if the actual price had been the same as the standard price, Medina would have had to pay \$200 more than it should have for the materials used, given the number of footballs produced, because it used too much material.

### The Price Variance

Though it is commonly called the "price variance" for materials, the more complete name for this variance is the "price usage variance." The variance is called the "price usage variance" to distinguish it from the "purchase price variance," which will be covered next. For the sake of brevity, from this point onward "price variance" will be used to mean the "price usage variance."

The price variance is calculated as:

$$\begin{aligned} & (\text{Actual Price} - \text{Standard Price}) \times \text{Actual Quantity} \\ & \text{or} \\ & \mathbf{(AP - SP) \times AQ} \end{aligned}$$

The price variance formula is used to calculate the portion of the total variance that was due to a difference between what was paid (the actual price) and the amount budgeted to be paid (the standard price) per unit of direct materials used.

In the example above, the **price variance** is calculated as:  
 $(\$4.50 - \$5.00) \times 290 = \$ (145)$

Medina saved \$145 because the price of the leather was lower than expected, a **favorable variance**. A negative variance for a cost is a favorable variance because it means the actual cost was lower than the budgeted cost. Even though Medina used more leather than it should have for each football it manufactured, it saved \$0.50 per square meter of leather actually used because the price was lower than expected.

The variance of \$(145) means that, because the price per square meter was lower than expected, the company's cost for direct materials was \$145 lower for the amount of materials it actually used than the standard cost for that quantity of materials.

Adding these two variances together results in the total materials variance.

Quantity variance	\$ 200	U
Price variance	<u>(145)</u>	F
Total Variance	<u>\$ 55</u>	U

In total, Medina had a positive variance of \$55, which is **unfavorable**, because the cost for the extra leather that was used was more than the savings on each square meter of leather used.

### Materials Purchase Price Variance

A materials price variance computed at the time of purchase is called a **materials purchase price variance**. Note that this variance is called the "materials purchase price variance," which is different from the materials price usage variance we calculated above. The materials purchase price variance is calculated in exactly the same way as the materials price usage variance, except the AQ (Actual Quantity) used in the formula is the quantity of direct materials **purchased**, not the quantity of direct materials **used**.

For better control, materials price variances should be determined as soon as materials are received, not when the materials are put into production. If the variance is not computed until the materials are requisitioned for production, corrective action will be more difficult because more time will have elapsed from the purchase.

If an exam question asks for the **purchase price variance**, calculate the purchase price variance using **all of the units purchased**, not just the units that were put into production. You need to be certain to notice the word "purchase" if it is used since it changes the way the variance is calculated. If an exam question is about the purchase price variance, it will give information that will enable you to know it is asking for the purchase price variance. However, a question may not call the variance the purchase price variance. Instead, a question may describe the materials purchase price variance, to test whether you know what the materials purchase price variance is.

#### Exam Tip:

- If a question asks for the **materials price variance** (or **materials price usage variance**), use the units **used**, not the units purchased, in the variance calculation.
- If a question asks for the **materials purchase price variance**, or if the question says that the company recognizes variances **as early as possible** (or some other description of the materials purchase price variance), use the **quantity purchased** instead of the quantity used.

Most questions ask for the materials price usage variance, using the units placed into production. However, a question could be about the materials purchase price variance instead. Therefore, be aware of this possible variation.

**Note:** The materials price variance (or materials price **usage** variance) is calculated at the time of **usage**, while the materials **purchase** price variance is calculated at the time of **purchase**.

**Note:** On the exam, you will need to identify possible reasons why a particular variance is favorable or unfavorable. You should usually be able to do this by common sense. For example, an unfavorable quantity variance may be caused by the purchasing department because it bought an inferior product that was damaged or broken, or it may be caused by new, untrained employees or poor techniques.

In the Medina Co. example, the variances could be due to the purchasing department's having gotten a good price on inferior leather that was damaged in the production process or was not always of an acceptable quality.

### Accounting for Direct Materials Variances in a Standard Cost System

Standard costing systems use actual variance accounts to record the variances from the standard costs as they occur. The way the accounting is done depends upon whether materials price variances are recognized when the direct materials are purchased (materials **purchase price** variance) or when the direct materials are put into production (materials **price usage** variance).

### Accounting for Materials *Purchase Price* Variances

Purchases of direct materials are recorded as debits to the Materials Inventory account at their **standard cost**, while the actual amount due the vendor is credited to Accounts Payable. Any difference between the actual price and the standard price for the quantity of materials purchased is recorded in the Materials Purchase Price Variance account.

When the direct materials are put into production, work-in-process inventory is debited for the standard cost of the amount of direct materials **allowed** for the actual units produced. The Materials Inventory account is credited for the standard cost of the **actual** amount of direct materials used for the actual units produced. The difference is debited or credited to the Materials Quantity Variance account.

In this system, the price variance is recognized when the materials are purchased, while the quantity variance is recognized when they are used. Also, in this system **inventory is valued at standard cost**.

See Example #1 that follows.

**Example #1: Materials Purchase Price Variance**

Prinz Company's standard cost for direct materials is \$8.00 per unit of direct materials. **Prinz recognizes materials price variances as soon as possible.** Two units of direct materials are allowed per unit produced. Prinz purchases 10,000 units of direct materials at \$7.50 per unit, for a total of \$75,000. When the materials are received on August 1, the cost accountants calculate the price variance as follows:

$$\begin{aligned}\text{Price Variance} &= (\text{AP} - \text{SP}) \times \text{AQ} \\ \text{Price Variance} &= (\$7.50 - \$8.00) \times 10,000 \\ \text{Price Variance} &= \$5,000 \text{ Favorable}\end{aligned}$$

Prinz records the receipt with the following entries:

Direct Materials Inventory/Control	80,000	[\$8.00 <b>standard</b> × 10,000 purchased]
Accounts Payable	75,000	[\$7.50 <b>actual</b> × 10,000 purchased]
Materials Purchase Price Variance	5,000	[\$0.50 favorable price variance × 10,000 purchased]

One batch consists of 4,000 units. On August 15, 8,200 units of direct materials are requisitioned and used to produce one batch. The cost accountants now calculate the quantity variance as follows:

$$\begin{aligned}\text{Quantity Variance} &= (\text{AQ} - \text{SQ}) \times \text{SP} \\ \text{Quantity Variance} &= (8,200 - 8,000) \times \$8.00 \\ \text{Quantity Variance} &= \$1,600 \text{ Unfavorable}\end{aligned}$$

The entries to record the usage of materials are:

Work-in-Process Inventory	64,000	[\$8.00 std. × 4,000 FG units × 2 units allowed/FG unit]
Materials Quantity Variance	1,600	[\$8.00 std. × 200 pcs. unfavorable quantity variance]
Direct Materials Inventory/Control	65,600	[\$8.00 std. × 8,200 pcs. actually used]

The balance of direct materials from this purchase of 10,000 units remaining in Direct Materials Inventory (also called Direct Materials Control) is \$14,400 (\$80,000 – \$65,600), representing 1,800 units on hand (10,000 units purchased – 8,200 units requisitioned) at the standard cost of \$8.00 per unit.

**Accounting for Materials Price Usage Variances**

Purchases of direct materials are recorded as debits to the Materials Inventory account at their **actual cost** and Accounts Payable is credited for the actual cost. **No variance is calculated at this time.**

When the direct materials are put into production, work-in-process inventory is debited for the **standard cost** of the amount of direct materials **allowed** for the actual units produced, and the Materials Inventory account is credited for the **actual cost** of the amount of direct materials **actually used** for the actual units produced. The difference between the two amounts is a combination of the price variance and the quantity variance. The amount for each variance is debited or credited to the Materials Quantity Variance account and debited or credited to the Materials Price Usage Variance account, as appropriate.

In this system, **materials inventory is recorded at its actual cost.**

See Example #2 that follows.



**Example #2: Materials Price Usage Variance**

Prinz Company's standard cost for direct materials is \$8.00 per unit of direct materials. **Prinz recognizes material price variances when the materials are used.** Two units of direct materials are allowed per unit produced. Prinz purchases 10,000 units of direct materials at \$7.50 per unit, for a total of \$75,000. When the materials are received on August 1, Prinz records the receipt with the following entries:

Direct Materials Inventory/Control	75,000	[\$7.50 actual × 10,000 purchased]
Accounts Payable	75,000	[\$7.50 actual × 10,000 purchased]

One batch consists of 4,000 units. On August 15, 8,200 units of direct materials are requisitioned and used to produce one batch. Prinz calculates the price and quantity variances for the units of direct materials used as follows:

Price Variance = (AP – SP) × AQ  
 Price Variance = (\$7.50 – \$8.00) × 8,200  
 Price Variance = \$4,100 Favorable

Quantity Variance = (AQ – SQ) × SP  
 Quantity Variance = (8,200 – 8,000) × \$8.00  
 Quantity Variance = \$1,600 Unfavorable

Compare these variances to those calculated in Example #1. The Quantity Variance is the same, but the Price Variance is different.

The entries to record the usage are:

Work-in-Process Inventory	64,000	[\$8.00 std. × 4,000 FG units × 2 units allowed/FG unit]
Materials Quantity Variance	1,600	[\$8.00 std. × 200 pcs. unfavorable quantity variance]
Direct Materials Inventory/Control	61,500	[\$7.50 std. × 8,200 pcs. actually used]
Materials Price Usage Variance	4,100	[\$0.50 favorable price variance × 8,200 pcs. used]

Compare these entries with the entries made in Example #1. The amounts debited to work-in-process inventory when the materials are put into production are the same: 8,000 standard quantity × \$8.00 standard price, or \$64,000.

However, the balances remaining in Direct Materials Inventory (or Direct Materials Control) are different. The balance remaining in Example #1 was \$14,400 (1,800 units at \$8.00 per unit). The balance remaining in this example is \$13,500 (1,800 units at \$7.50 per unit). The balance of direct materials in Materials Inventory/Control can also be calculated as \$75,000 minus \$61,500. There is a difference in the materials inventory balance between the two examples because in Example #1 the materials are debited to materials inventory/control at their standard cost, whereas in Example #2 the materials are debited to materials inventory/control at their actual cost, which in this example is lower.

Recording the variances in separate variance accounts accomplishes two things:

- 1) It isolates the variances so they can be analyzed.
- 2) It maintains standard costs in the Work-In-Process Inventory accounts during the production process.

At the end of the period, the variances are closed out, either to cost of goods sold or, if they are material, they should be prorated among direct materials inventory, work-in-process inventory, finished goods inventory, and cost of goods sold.<sup>42</sup>

<sup>42</sup> According to U.S. federal income tax regulations, for tax reporting significant standard cost variances must be apportioned between inventories and cost of goods sold. If the variance amount is not significant relative to total incurred costs, allocation between inventories and cost of goods sold is required **only** if the company allocates the variances in its financial reporting. See *Code of Federal Regulations*, Sections 1.471-11(d)(3) and Section 1.263A-1(f)(3)(ii)(B) for the tax statutes.

**Note:** Over a long enough time period, both methods will produce the same total expenses and profits because in the long-term all expenses will go to the income statement. The difference between these methods is one of allocation between periods, not a question of totality.

**Exam Tip:** For the exam you need to be able to use these formulas to solve for the variance itself and also to solve for any of the individual variables in these formulas.

For example, each variance uses three amounts to calculate the variance. In a straightforward question, the variance is the unknown. The amounts for the formula (AP, SP, AQ, or SQ) are on the left side of the equals sign and the calculated variance is on the right.

Instead, you may be given the variance and two of the amounts for the formula (or you may be given enough information to determine what they are) and to answer the question, you will need to solve for the third amount on the left side of the equals sign, which will be the unknown. To do the calculation, you will simply use the same formulas but use algebra to solve for a different unknown.

**The following information is for the next three questions:** ChemKing uses a standard costing system in the manufacture of its single product. The 35,000 units of raw material in inventory were purchased for \$105,000, and 2 units of raw materials are required to produce 1 unit of final product. In November, the company produced 12,000 units of product. The standard cost for material allowed for the output was \$60,000, and there was an unfavorable quantity variance of \$2,500.

Question 111: ChemKing's standard price for one unit of material is:

- a) \$2.00
- b) \$2.50
- c) \$3.00
- d) \$5.00

Question 112: The units of material used to produce November output totaled:

- a) 12,000 units.
- b) 12,500 units.
- c) 23,000 units.
- d) 25,000 units.

Question 113: The materials price variance for the units used in November was:

- a) \$2,500 unfavorable.
- b) \$11,000 unfavorable.
- c) \$12,500 unfavorable.
- d) \$3,500 unfavorable.

(CMA Adapted)

Question 114: Garland Company uses a standard cost system. The standard for each finished unit of product allows for 3 pounds of plastic at \$0.72 per pound. During December, Garland bought 4,500 pounds of plastic at \$0.75 per pound, and used 4,100 pounds in the production of 1,300 finished units of product. What is the materials price variance for the month of December?

- a) \$117 unfavorable.
- b) \$123 unfavorable.
- c) \$135 unfavorable.
- d) \$150 unfavorable.

(CMA Adapted)

Question 115: Price variances and efficiency variances can be key to the performance measurement within a company. In evaluating performance, all of the following can cause a materials efficiency variance except the:

- a) Performance of the workers using the material.
- b) Actions of the purchasing department.
- c) Design of the product.
- d) Sales volume of the product.

(CMA Adapted)

## Direct Labor Variances

As with the materials variance, the **total labor variance** (also called the **flexible budget variance**) is the difference between the standard labor costs allowed for the actual level of output (the flexible budget) and the actual labor costs incurred by the company. Also similar to the materials variance, this total variance is attributable to variances in both labor rates and labor usage, meaning that the company either paid a different wage rate than standard, used a different number of labor hours than standard for this level of output, or did both.

Because the direct labor variances are so similar to variance analysis for materials, they will not be covered in detail again. Briefly, the total labor variance can be broken down into the labor rate variance (a price variance) and the labor efficiency variance (a quantity variance). Direct labor price and quantity variances are calculated in the exact same manner as the direct material price and quantity variances; but, when direct labor is analyzed, different names are used for the price and quantity variances.

### The Direct Labor Rate Variance

The direct labor rate variance is calculated in the same manner as the direct materials price variance:

$$(\text{Actual Rate} - \text{Standard Rate}) \times \text{Actual Hours}$$

or

$$(\text{AP} - \text{SP}) \times \text{AQ}$$

### The Direct Labor Efficiency Variance

The direct labor efficiency variance is calculated the same manner as the direct materials quantity variance:

$$(\text{Actual Hours} - \text{Standard Hours for Actual Output}) \times \text{Standard Rate}$$

or

$$(\text{AQ} - \text{SQ}) \times \text{SP}$$

**Exam Tip:** As with direct material variances, for the exam you need to be able to use these formulas to solve for the variance itself and also to solve for any of the individual variables in these formulas.

For example, each variance uses three amounts to calculate the variance. In a straightforward question, the variance is the unknown. The amounts for the formula (AP, SP, AQ, or SQ) are on the left side of the equals sign and the calculated variance is on the right.

Instead, you may be given the variance and two of the amounts for the formula (or you may be given enough information to determine what they are) and to answer the question, you will need to solve for the third amount on the left side of the equals sign, which will be the unknown. To do the calculation, you will simply use the same formulas but use algebra to solve for a different unknown.

### Accounting for Direct Labor Variances in a Standard Cost System

The production payroll is recorded by debiting Work-In-Process Inventory for the total number of **standard hours for the units manufactured** at the **standard hourly rate**. The credit is to accrued payroll at the **total number of hours actually spent** and at the **actual hourly rate**. The difference between the two is recorded in the Direct Labor Rate Variance (the price variance) and the Direct Labor Efficiency Variance (the quantity variance) accounts. For both the Rate Variance and the Efficiency Variance, unfavorable variances are recorded as debits and favorable variances are recorded as credits.

As with direct materials variances, direct labor variances are closed out at the end of the period, either to cost of goods sold or, if they are material, prorated among work-in-process inventory, finished goods inventory, and cost of goods sold.<sup>43</sup>

Unlike the direct materials price variance, there can be no purchase price variance for direct labor because labor cannot be bought and stored the way materials can be.

**Note:** The company must decide how the costs of employee-related costs, such as employee benefits and payroll taxes, will be treated. These costs may be included in the cost of direct labor or treated as an overhead and allocated to the units produced in that way. The method in which these costs are treated may have a small effect on cost of goods sold, income, or inventory. Only in cases where direct labor is a large portion of the total expenses will this difference be significant.

Question 116: An unfavorable direct labor efficiency variance could be caused by a(n):

- a) Unfavorable variable overhead spending variance.
- b) Unfavorable materials usage variance.
- c) Unfavorable fixed overhead volume variance.
- d) Favorable variable overhead spending variance.

(CMA Adapted)

<sup>43</sup> According to U.S. federal income tax regulations, for tax reporting significant standard cost variances must be apportioned between inventories and cost of goods sold. If the variance amount is not significant relative to total incurred costs, allocation between inventories and cost of goods sold is required **only** if the company allocates the variances in its financial reporting. See *Code of Federal Regulations*, Sections 1.471-11(d)(3) and Section 1.263A-1(f)(3)(ii)(B) for the tax statutes.

**The following information is for the next three questions:** Jackson Industries employs a standard cost system that carries direct materials inventory at standard cost. Jackson has established the following standards for the prime costs of one unit of product:

	<u>Standard Quantity</u>	<u>Standard Price</u>	<u>Standard Cost</u>
Direct Materials	5 pounds	\$3.60 per pound	\$18.00
Direct Labor	1.25 hours	\$12.00 per hour	<u>15.00</u>
			\$33.00

During May, Jackson purchased 125,000 pounds of direct material at a total cost of \$475,000. The total factory wages for May were \$364,000, 90% of which were direct labor. Jackson manufactured 22,000 units of product during May, using 108,000 pounds of direct materials and 28,000 direct labor hours.

Question 117: The direct materials usage (quantity) variance for May is:

- a) \$7,200 unfavorable.
- b) \$7,600 favorable.
- c) \$5,850 unfavorable.
- d) \$7,200 favorable.

Question 118: The direct labor price (rate) variance for May is:

- a) \$8,400 favorable.
- b) \$7,200 unfavorable.
- c) \$8,400 unfavorable.
- d) \$6,000 unfavorable.

Question 119: The direct labor usage (efficiency) variance for May is:

- a) \$5,850 favorable.
- b) \$6,000 unfavorable.
- c) \$5,850 unfavorable.
- d) \$6,000 favorable.

(CMA Adapted)

Question 120: A company set the total budgeted direct labor cost at \$75,000 for the month for producing 5,000 units. The following standard cost, stated in terms of direct labor hours (DLH), was used to develop the budget for direct labor cost:

$$1.25 \text{ DLH} \times \$12.00/\text{DLH} = \$15.00/\text{unit produced}$$

The actual operating results for the month were as follows:

Actual units produced	5,200
Actual direct labor hours worked	6,600
Actual direct labor cost	\$77,220

The direct labor efficiency variance for the month would be:

- a) \$4,200 unfavorable.
- b) \$3,000 unfavorable.
- c) \$2,220 unfavorable.
- d) \$1,200 unfavorable.

(CIA Adapted)

### More than One Material Input or One Labor Class

Thus far we have outlined the variance analysis process when we have only one material input into the product or only one class of labor. (Each class of labor has a different wage rate).

A total variance, a price variance, and a quantity variance are still calculated in situations where more than one direct material input or more than one class of labor is used in producing the product. The difference when multiple inputs are used (called a mix of inputs) is that the quantity variance is broken down into two sub-variances: the **mix variance** and the **yield variance**.

The **mix variance** shows the portion of the quantity variance that resulted because the actual **mix** was different from the standard mix (that is, more of one ingredient was used and less of another ingredient was used). The **yield variance** shows the portion of the quantity variance that resulted because the **total** actual amount of all ingredients used was different from the **total** standard amount.

In a situation with multiple inputs, the price variance is not broken down the way the quantity variance is.

**Note:** The mix of inputs (labor or materials) is called a **weighted mix**. To calculate the mix and yield variances for a given batch, we will need to calculate the weighted average standard price of the **actual mix** used in the batch and the weighted average standard price of the **standard mix** for the batch.

### Total Variance of a Weighted Mix

The **total variance** of a weighted mix is the **Total Actual Cost** for labor or materials minus the **Total Standard Cost** for labor or materials.

We will illustrate all of these variances in a numerical example at the end of this section. In that example, we will be producing cereal using several different grains, so we will use cereal also in the smaller examples leading up to the large example.

Here are the facts that will be used in the examples that follow:

A company produces cereal made up of different grains. The material prices in effect for the fiscal year ending June 30 and the standard kilograms (kg) allowed for the output of April are:

	<u>Standard Price/Kg</u>	<u>Standard Kg for Output</u>	<u>Standard Cost</u>
Corn	\$10.00	250	\$2,500.00
Wheat	\$ 8.00	250	2,000.00
Rice	\$ 3.00	<u>250</u>	<u>750.00</u>
		<u>750</u>	<u>\$5,250.00</u>

Due to several natural disasters around the world, the price for each input increased on January 1. The standard prices were not revised, and the actual output in April was the same as planned.

The actual material prices and the actual usage for April were as follows:

	<u>Actual Price</u>	<u>Actual Usage</u>	<u>Actual Cost</u>
Corn	\$12.00	375	\$4,500.00
Wheat	\$ 8.50	200	1,700.00
Rice	\$ 5.50	<u>325</u>	<u>1,787.50</u>
		<u>900</u>	<u>\$7,987.50</u>

### Materials Price Variance (or Labor Rate Variance) of a Weighted Mix

The price variance of a weighted mix is the sum of the price variances for each component of the mix, each one calculated individually using the formula  $(AP - SP) \times AQ$ .

We will calculate a price variance for each separate input, and these individual price variances are then summed to calculate the total materials price variance.

### Total Materials Quantity or Labor Efficiency Variance of a Weighted Mix

The **total** materials quantity or labor efficiency variance of a weighted mix is the sum of the quantity variances for each component of the mix, each one calculated individually.

The formula  $(AQ - SQ) \times SP$  is used to calculate the quantity variance for each component of the mix separately. The individual quantity variances are then summed to calculate the total quantity variance.

Because more than one material is used in the production process, we cannot use the total materials quantity variance to determine exactly why the variance occurred. The variance may have occurred simply because a different total volume of materials was used in production (though the individual materials were used in the correct ratio). Alternatively, it may have occurred because a different mix of materials was used, even though the total volume of the materials used was equal to the standard. Of course, the variance could have also been caused by differences from the standards for both the total volume and the mix.

"A different mix" means that the actual ratio of the inputs into the product was different from the standard ratio of inputs for the product. In the example used here, instead of the input mix for cereal consisting of equal parts of corn, wheat and rice, it turned out to be 42% corn, 22% wheat, and 36% rice. The total volume of corn, wheat, and rice may have been equal to the total standard volume of 750 kilograms allowed for April's production, though in this example it was 900 kilograms instead. Regardless of the total volume used, because the ratio of the inputs used was different from the standard ratio of inputs, a total materials quantity variance arose.

When we break down this total materials quantity or labor efficiency variance into two sub-variances (the **mix** and the **yield** variances) we are able to see how much each of these factors contributed to the total quantity variance. (The same process for calculating the mix and yield variances is used for labor and materials.)

### 1) The *Mix* Variance (Materials or Labor)

**Note:** This is the first of the two sub-variances of the total quantity variance.

The mix variance is the portion of the quantity variance that results from the actual mix of materials used or the actual mix of the labor used being different from the standard mix that should have been used. Returning to the cereal example, the cause of a mix variance would be including a higher percentage of corn and rice and a lower percentage of wheat in the cereal than called for by the standard.

A mix variance could occur if the company's inventory of wheat is low and it deliberately substitutes corn and rice for a portion of the wheat required. A mix variance could also occur accidentally if, for example, the wrong proportions are used when the materials are added to the production process.

**Note:** Variances are calculated in order to determine the cause or causes of variances from the standard, or planned, amounts. Once the variances have been calculated, the person who made the decisions that resulted in each variance should be responsible for explaining why the variance occurred. Responsibility for explaining a mix variance should be given to an individual **only** if that person actually had control over the mix and over substitutions made in the mix during the reporting period when the variance arose.

The formula used to calculate the mix variance is a variation of the **price variance** formula:  $(AP - SP) \times AQ$ . Instead of using the actual and standard prices for the input, we use **weighted average standard prices**. We calculate the weighted average standard price of the **actual** mix and the weighted average standard price of the **standard** mix, as follows:

- 1) The **weighted average standard price of the actual mix**: the actual quantity used for each input is multiplied by the standard cost for that input, the products are summed, and the sum is divided by the total volume of all inputs used. The result is the weighted average standard price of one unit of the actual mix.

The weighted average standard price that results from this calculation is how much one standard input **should** have cost, based on the actual mix used. In the example of cereal, at the end of April we determine the actual mix used in the production of cereal and calculate how much one kilogram of this actual mix of grains (42% corn, 22% wheat, and 36% rice) **should** have cost. In order to calculate how much one kilogram of the actual mix **should** have cost, we use the standard price for each input.

The weighted average standard price of the actual mix cannot be calculated until after the end of the reporting period, because the actual inputs used cannot be known until that time.

- 2) The **weighted average standard price of the standard mix**: The standard quantity of each input **allowed for the actual output** is multiplied by the standard cost for each input, the results are summed, and the sum is divided by the total volume of all inputs allowed for the actual output.

The weighted average standard price for the standard output that results from this calculation is how much one standard unit of the mix **should** have cost, based on the standard mix allowed for the actual output. In the example of cereal, we determine how much one kilogram of the standard mix allowed for the actual output (1/3 each of corn, wheat and rice) **should** have cost.

The weighted average standard price of the standard mix can be calculated at the beginning of the period even though the actual output is not known at that point. The weighted average standard price of the standard mix will be the same regardless of the volumes used for each input in the calculation, as long as the standard cost per kilogram of each input and the standard ratio of the inputs to one another are used in the calculation.

Calculations of the weighted average standard price of the actual mix and the weighted average standard price of the standard mix will be demonstrated in the comprehensive example that follows this explanation. (It is not as bad as it sounds.)



The mix variance is calculated as follows:

$$\left( \begin{array}{l} \text{Weighted Average Standard Price of the } \mathbf{Actual} \text{ Mix} - \\ \text{Weighted Average Standard Price of the } \mathbf{Standard} \text{ Mix} \\ \text{(both calculated using the } \mathbf{Standard} \text{ Price)} \end{array} \right) \times \mathbf{Actual Quantity of all} \\ \mathbf{material or labor inputs}$$

or

$$(\mathbf{waspAM} - \mathbf{waspSM})^{44} \times \mathbf{AQ}$$

**Note:** the way the mix variance is calculated is similar to the way a price variance is calculated, because a price variance is calculated as  $(AP - SP) \times AQ$ . However, the mix variance is not a price variance. The mix variance formula uses the **standard** price of both the actual mix and the standard mix.

To calculate the amount of any variance caused by a difference between the actual and the standard values of one variable, we isolate the actual and the standard for that variable within the parentheses. In the mix variance, we are calculating the amount of variance caused by a difference between the actual mix and the standard mix, so the mix is the item that must vary within the parentheses.

To isolate the difference between the actual mix and the standard mix, we need to use the same price for both mixes. Therefore, we use the "weighted average standard price" for both mixes and the variable that differs is the mix: actual mix (AM) versus standard mix (SM).

## 2) The Yield Variance (Material or Labor)

**Note:** This is the second of the two sub-variances of the total quantity variance.

The yield variance results from a difference between the **total actual quantity** of the inputs that were used to produce the actual output and the **total standard quantity** of inputs that should have been used to produce the actual output.

The formula to calculate the yield variance is a variation of the **quantity variance** of the mix:  $(AQ - SQ) \times SP$ . Instead of using the standard price of a single input, we use the **weighted average standard price of the standard mix, or waspSM**. (This is the same waspSM as was used in the calculation of the mix variance [above].)

The yield variance is calculated as follows:

$$\left( \begin{array}{l} \mathbf{Actual Total Quantity} \text{ of All Inputs} - \\ \mathbf{Standard Total Quantity} \text{ of All Inputs} \end{array} \right) \times \mathbf{Weighted Average Standard Price} \\ \mathbf{of Standard Mix of All Inputs}$$

or

$$(\mathbf{AQ} - \mathbf{SQ}) \times \mathbf{waspSM}$$

**Note:** In the formula above, the actual quantity of input to the product (AQ) is equal to the **total** kilograms or hours (or whatever else) **actually used** to produce the actual level of output.

The standard quantity of input to the product (SQ) is equal to the **total** kilograms or hours (or whatever else) that **should have been used** to produce the actual level of output.

**Note:** Remember, if a product has only one input, there is no need to calculate these two additional variances.

The total variance, the price variance, the quantity variance, and the materials mix and yield variances are calculated on the following pages in the comprehensive example for the weighted cereal mix.

<sup>44</sup> Note: "waspAM" and "waspSM" are abbreviations that are unique to HOCK study materials, as is the method presented here for calculating the mix and yield variances. The method presented here is simpler than the method taught in most cost accounting textbooks, and it results in the correct variances. If you use these abbreviations in an answer to an exam essay question, you should explain what they stand for so that the grader can understand what you are doing.

**Example:** We will use the following information to calculate the following variances and items:

- 1) Total variance
- 2) Materials price variance
- 3) Materials quantity variance
- 4) Weighted average standard price of the standard mix (waspsM)
- 5) Weighted average standard price of the actual mix (waspsAM)
- 6) Mix variance
- 7) Yield variance

A company produces cereal made up of different grains. The material prices in effect for the fiscal year ending June 30 and the standard kilograms (kg) allowed for the output of April are:

	<u>Standard Price/Kg</u>	<u>Standard Kg for Output</u>	<u>Standard Cost</u>
Corn	\$10.00	250	\$2,500.00
Wheat	\$ 8.00	250	2,000.00
Rice	\$ 3.00	<u>250</u>	<u>750.00</u>
		<u>750</u>	<u>\$5,250.00</u>

Due to several natural disasters around the world, the price for each input increased on January 1. The standard prices were not revised, and the actual output in April was the same as planned.

The actual material prices and the actual usage for April were as follows:

	<u>Actual Price</u>	<u>Actual Usage</u>	<u>Actual Cost</u>
Corn	\$12.00	375	\$4,500.00
Wheat	\$ 8.50	200	1,700.00
Rice	\$ 5.50	<u>325</u>	<u>1,787.50</u>
		<u>900</u>	<u>\$7,987.50</u>

### 1) Total Variance

The total variance is the difference between the **standard cost for the actual level of output** and the **actual cost**. The standard cost for April was \$5,250. The actual cost for April was \$7,987.50. This gives a **total unfavorable variance of \$2,737.50**, which is broken down into the price and the quantity variances as below.

### 2) Materials Price Variance

The materials price variance is calculated by determining the price variance for each of the three products individually and summing them. The formula is  $(AP - SP) \times AQ$  and the 3 calculations are:

Corn	$(\$12 - \$10) \times 375$	=	\$ 750.00
Wheat	$(\$8.50 - \$8) \times 200$	=	100.00
Rice	$(\$5.50 - \$3) \times 325$	=	<u>812.50</u>

Total Materials Price Variance **\$1,662.50 Unfavorable**

### 3) Materials Quantity Variance

The total materials quantity variance is calculated by using the usage formula  $(AQ - SQ) \times SP$  for each of the classes individually and then summing them:

Corn	$(375 - 250) \times \$10$	=	\$ 1,250.00
Wheat	$(200 - 250) \times \$8$	=	(400.00)
Rice	$(325 - 250) \times \$3$	=	<u>225.00</u>

Total Materials Quantity Variance **\$1,075.00 Unfavorable**

At this point, we can do a simple test of the two main variances. The price variance plus the quantity variance should equal the total variance. This is true:  $\$1,662.50 + \$1,075.00 = \$2,737.50$ .

(Continued)

### Calculation of Mix and Yield Variances

From this point, we need to calculate the mix variance and the yield variance, and when those two items are summed they must equal \$1,075, the total material quantity variance.

The first step is to calculate waspAM and waspSM. We will repeat the information about the actual and standard prices and quantities, but this time we will add some labels to clarify the information. The unused information has been made lighter and the boxes have been clearly labeled.

	Standard Price <b>SP</b> <u>Standard Price/Kg</u>	Standard Quantity <b>SM</b> <u>Standard Kg for Output</u>	Standard Cost
Corn	\$10.00	250	\$2,500.00
Wheat	\$ 8.00	250	2,000.00
Rice	\$ 3.00	<u>250</u>	<u>750.00</u>
		<u>750</u>	<u>\$5,250.00</u>
	<b>NOT USED</b> <u>Actual Price</u>	Actual Quantity <b>AM</b> <u>Actual Usage</u>	Actual Cost
Corn	<del>\$12.00</del>	375	\$4,500.00
Wheat	<del>\$ 8.50</del>	200	1,700.00
Rice	<del>\$ 5.50</del>	<u>325</u>	<u>1,787.50</u>
		<u>900</u>	<u>\$7,987.50</u>

The first step in calculating the mix and yield variances is to calculate waspAM and waspSM. Since the mix and yield variances are subdivisions of the total quantity variance, the actual price **is not used**. The actual price is used in calculating the price variance, but it is not used for quantity variances such as we are calculating here.

Note that arrows have been added to show the sources of the values used in the calculations of waspAM and waspSM.

**4) The Weighted Average Standard Price of the Standard Mix (waspSM)** is calculated as follows:

$$\text{Total Standard Cost} \div \text{Total Standard Kgs}$$

The total standard kilograms is 750 and the total standard cost is calculated as follows:

Corn	\$10 × 250 kg =	\$2,500
Wheat	\$ 8 × 250 kg =	2,000
Rice	\$ 3 × <u>250</u> kg =	<u>750</u>

**Total Standard Cost                      750 kg              \$5,250**

The **waspSM is \$7.00 per kg** (\$5,250 ÷ 750).

**5) The Weighted Average Standard Price of the Actual Mix (waspAM)** is calculated as follows:

$$\text{Total Cost using Actual Kg and Standard Price} \div \text{Total Actual Kg}$$

The total actual kg was 900 and the total standard cost of the actual mix is calculated as follows:

Corn	\$10 × 375 kg =	\$3,750
Wheat	\$ 8 × 200 kg =	1,600
Rice	\$ 3 × <u>325</u> kg =	<u>975</u>

**Total Cost at Standard Rate              900 kg              \$6,325**

The **waspAM is \$7.0277 per kg** (\$6,325 ÷ 900).

(Continued)

Because the mix was wrong, the weighted average standard price of each kilogram of actual input used was \$0.0277 more than it should have been.

#### 4) Mix Variance

The mix variance is the portion of the total material quantity variance that resulted from the actual mix being different from the standard mix. The mix variance is the difference between the weighted average standard prices of the actual and the standard mix multiplied by the actual total quantity used of all inputs. The formula is:

$$(\text{waspAM} - \text{waspSM}) \times \text{AQ}$$

Putting the numbers we calculated into the formula  $(\text{waspAM} - \text{waspSM}) \times \text{AQ}$ , we get the following:

$$(\$7.0277 - \$7.00) \times 900 = \textbf{\$25 Unfavorable Materials Mix Variance}$$

Therefore, \$25 of the \$1,075 unfavorable quantity variance arose because the mix of grains was not correct.

#### 5) Yield Variance

The yield variance is the portion of the quantity variance that occurred as a result of using more or less total input than the standard total input. In calculating this variance, we are not worried about the mix of the inputs, just the total quantity of inputs used. The formula is:

$$(\text{AQ} - \text{SQ}) \times \text{waspSM}$$

The waspSM was \$7.00 per kilogram from the previous calculations, the Actual Quantity was 900 kilograms, and the Standard Quantity was 750 kilograms.

Putting all of this into the formula, we get the following:

$$(900 - 750) \times \$7 = \textbf{\$1,050 Unfavorable Materials Yield Variance}$$

Therefore, \$1,050 of the \$1,075 unfavorable quantity variance occurred because the company used more material input than it should have for the amount of output.

#### Summary, Reconciliation, and Interpretation

From these calculations, we see that the change in the mix was not a material cause of the unfavorable quantity variance, since it was responsible for only \$25 of the unfavorable variance. Rather, the unfavorable quantity variance was primarily caused by a general inefficiency in the use of the material inputs.

To prove all of the calculations, we can do a simple check comparing the two sub-variances to the total quantity variance:

	Materials Mix Variance	\$ 25 U
+	<u>Materials Yield Variance</u>	<u>1,050 U</u>
=	<b>Total Materials Quantity Variance</b>	<b><u>\$1,075 U</u></b>

**The following information is for the next two questions:** Azat Corporation produces ketchup. Azat mixes two varieties of tomatoes: a locally grown variety to provide excellent taste and an imported variety to provide a richer color. The standard costs and inputs for a 200-kg batch of ketchup are as follows:

<u>Tomato Type</u>	<u>Standard Quantity in Kg.</u>	<u>Standard Cost per Kg</u>	<u>Total Cost</u>
Local	200	\$0.75	\$150
Imported	<u>100</u>	\$0.90	<u>90</u>
Total	<u>300</u>		<u>\$240</u>

A total of 110 batches were produced during the current period. The quantities actually purchased and used during the current period as well as the prices paid are shown below:

<u>Tomato Type</u>	<u>Quantity in Kg.</u>	<u>Actual Cost per Kg</u>	<u>Total Cost</u>
Local	21,000	\$0.65	\$13,650
Imported	<u>14,000</u>	\$0.95	<u>13,300</u>
Total	<u>35,000</u>		<u>\$26,950</u>

Question 121: What is the materials mix variance for the current period?

- a) \$1,050 favorable
- b) \$350 favorable.
- c) \$1,050 unfavorable.
- d) \$350 unfavorable.

Question 122: What is the materials yield variance for the current period?

- a) \$1,600 favorable.
- b) \$1,600 unfavorable.
- c) \$1,620 unfavorable.
- d) \$1,620 favorable.

(HOCK)

## Factory Overhead Variances

Overheads are production and operation costs that a company cannot trace to any specific product or unit of a product. Because these costs are incurred and paid for by the company and are necessary for the production process, the company needs to know what these costs are and allocate them to the various products that are produced. This allocation must occur so that the full costs of production and operation are known in order to set the selling prices for the different products. If a company does not take overheads into account when it determines the selling price for a product, there is significant risk that it will price the product so that it is actually selling at a loss. The price that a company charges may cover the direct costs of production, but it may not cover all of the indirect costs of production.

Furthermore, generally accepted accounting principles require the use of absorption costing for external financial reporting. In absorption costing, all overhead costs associated with manufacturing a product become a part of the product's cost base along with the direct costs. Along with the direct costs, the overhead costs flow to the income statement as cost of goods sold when the units they are attached to are sold. Therefore, all manufacturing overhead costs must be allocated to the units produced.

Factory overhead costs are segregated into variable overheads that increase or decrease in total with increased or decreased production and fixed overheads that ordinarily do not change in total as a result of changes in the production level<sup>45</sup>. Thus, factory overhead variances are also segregated into variable overhead variances and fixed overhead variances.

Factory overhead costs are incurred as production takes place, and an estimated amount is applied to each unit as manufacturing takes place. The amount of overhead costs to be applied to each unit produced is usually based on the standard usage allowed per unit of a **cost allocation base**<sup>46</sup>. The standard usage allowed for a reporting period is the usage of the allocation base allowed for the actual production level achieved<sup>47</sup> during the period.

**The overhead allocation rate is predetermined<sup>48</sup> at the beginning of the period by dividing the total budgeted overhead cost by the budgeted usage of the allocation base or by the budgeted production level in units.** As with other manufacturing costs, overhead costs are applied to production as production takes place using the predetermined or standard rate instead of an actual incurred rate, because the actual rate is not known until after the end of the period.

Common cost allocation bases used to allocate overhead to products are direct labor hours and machine hours allowed for the actual production of one unit of product. Thus the incurring of factory overhead costs is separate from the application of those costs to the products manufactured. Differences between the overhead costs incurred and the overhead costs applied account for the majority of factory overhead variances.

We begin with the total overhead variance, move on to variable overhead variances, and conclude with the fixed overhead variances. Both the total variable overhead variance and the total fixed overhead variance can be broken down into two sub-variances, similar to the way that the direct material and labor variances were broken down. Therefore, you need to know four individual variances that are calculated for factory overhead.

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<sup>45</sup> Fixed factory overhead costs are fixed as long as production activity remains within a given range, called the **relevant range**. If production drops below the relevant range or increases above the relevant range, fixed overhead will change, and then it will again be fixed as long as production remains within the new relevant range.

<sup>46</sup> A cost allocation base is a measure of activity that is used to assign costs to cost objects. Direct labor hours and machine hours are commonly used as cost allocation bases for factory overhead. A cost object is anything for which cost information is desired.

<sup>47</sup> This discussion assumes that standard costing and flexible budgeting are being used.

<sup>48</sup> Determination of the predetermined overhead allocation rate is explained in Section B of this text, within the major topic *Setting Standard Costs* under the minor topic headings *Establishing Manufacturing Overhead Standards* and *Determining the Level of Activity to Use*.

The four individual variances are:

- 1) Variable overhead spending variance.
- 2) Variable overhead efficiency variance.
- 3) Fixed overhead spending variance.
- 4) Fixed overhead production-volume variance.

The four overhead variances can be combined in various ways, such as four-way, three-way, and two-way analyses. The different methods are simply different combinations of the same four variances. We will first look at the four variances individually and then look at the different combinations.

### Overview of Total Manufacturing Overhead Variances

Before looking at more specific overhead variances, we will start with a very general overhead variance. The total overhead variance includes both the variable and the fixed overhead variances:

$$\begin{aligned}
 & \text{Actual total variable and fixed overhead incurred (money actually spent on these items)} \\
 & - \text{Total variable and fixed overhead applied to production using predetermined rates} \\
 & = \text{Total Overhead Variance}
 \end{aligned}$$

As with all cost variances, a positive variance is unfavorable and a negative variance is favorable.

The total overhead variance is the same as the amount of over- or under-applied factory overhead. Over- and under-applied overhead is calculated as Actual Overhead Incurred minus Applied Overhead. The formula above is the same formula as the formula for over- and under-applied overhead.

The total overhead variance is **not** the difference between actual overhead incurred and budgeted overhead. Rather, it is the difference between the actual overhead incurred and the **overhead applied to production**. (This subject will be covered in more detail later.)

The total overhead variance is divided into the total variable overhead variance and the total fixed overhead variance. The total variable and total fixed overhead variances are calculated the same way as the total overhead variance: actual overhead incurred minus overhead applied to production. (The calculation is explained below.)

The total variable and total fixed overhead variances are both subdivided into two other sub-variances:

Variable overhead <i>spending</i> variance	Fixed overhead <i>spending</i> variance
+ Variable overhead <i>efficiency</i> variance	+ Fixed overhead <i>production volume</i> variance
= Total variable overhead variance	= Total fixed overhead variance

### Variable Overhead (VOH) Variances

Variable overheads are overhead costs that change as the level of production changes. Examples of variable overheads are plant electricity, equipment maintenance, other utilities, and so forth. Overhead costs cannot be traced to specific units manufactured, and for that reason they are called overhead costs. However, since they do increase when production increases and decrease when production decreases, they are variable costs.

**Total Variable Overhead Variance (or Variable Overhead Flexible Budget Variance)**

The total variable overhead variance is equal to the difference between the actual variable overhead incurred and the standard variable overhead applied. The standard variable overhead applied is based on the standard usage (given the actual output) of the overhead allocation base (machine hours, direct labor hours, and so forth).

$$\begin{aligned}
 & \text{Actual total variable overhead incurred (money spent on these items)} && (\text{AP} \times \text{AQ}) \\
 - & \text{Variable overhead applied to production using predetermined rate}^{49} && (\text{SP} \times \text{SQ}) \\
 = & \text{Total variable overhead variance}
 \end{aligned}$$

The interpretation of the Variable Overhead Variance is the same as for other cost variances:

- A **positive** variance is an **unfavorable** variance because actual costs were **greater than** costs applied, and
- A **negative** variance is a **favorable** variance because actual costs were **less than** the amount of cost applied.

**Note:** This calculation is also referred to as the amount of variable overhead that was over- or under-applied.

The total variable overhead variance may be broken down into the **spending** and **efficiency** variances.

**1) Variable Overhead Spending Variance**

This variance is the difference between the **actual amount of variable overhead incurred** and the **standard amount of variable overhead allowed for the actual quantity of the VOH allocation base used for the actual quantity produced**.

The variable overhead spending variance is essentially a price variance and this variance is caused by a difference between the actual variable overhead cost per unit of the allocation base (calculated as the actual overhead costs ÷ the actual usage of the allocation base) and the standard application rate per unit of the application base.

$$\begin{aligned}
 & \text{Actual total variable overhead incurred (money actually spent)} && (\text{AP} \times \text{AQ}) \\
 - & \text{Budgeted variable overhead based on inputs actually used} && (\text{SP} \times \text{AQ}) \\
 = & \text{Variable overhead spending variance}
 \end{aligned}$$

The interpretation of the Variable Overhead Spending Variance is the same as for other cost variances:

- A **positive** variance is an **unfavorable** variance because actual costs were **greater than** budgeted costs, and
- A **negative** variance is a **favorable** variance because actual costs were **less than** budgeted costs.

**Note:** The first line of this formula is the same as the first line of the total variable overhead formula.

The budgeted variable overhead, based on inputs actually used, is the standard (budgeted) variable overhead rate per hour (machine hour or direct labor hour, as appropriate) multiplied by the number of hours **actually used** to produce the actual output.

<sup>49</sup> Overhead is applied to individual products produced, usually on the basis of either direct labor hours, machine hours, materials costs, units of production, weight of production, or some other similar measure. Overhead is covered in depth in Section D, *Cost Management*. The "variable overhead applied to production" is calculated as (Standard Rate × Standard Quantity Allowed for the Actual Production Level).



The variable overhead spending variance can also be calculated as follows:

$$\left( \begin{array}{l} \text{Actual VOH Cost Per Unit of Allocation Base} \\ \text{Actually Used} - \text{Standard VOH Cost Per Unit of} \\ \text{Allocation Base [i.e., Standard Application Rate]} \end{array} \right) \times \begin{array}{l} \text{Actual Quantity of VOH Allocation Base} \\ \text{Used for Actual Output} \end{array}$$

or

$$(\text{AP} - \text{SP}^{50}) \times \text{AQ}$$

## 2) Variable Overhead Efficiency Variance

The variable overhead efficiency variance is essentially a quantity variance, and it determines the amount of the total variance caused by a different usage of the allocation base than was expected (that is, the standard hours allowed for the actual output). It measures the effect on variable factory overhead cost of efficient or inefficient use of the allocation base used to apply the variable overhead.

<b>Budgeted variable overhead based on inputs actually used</b>	(AQ x SP)
<b>– Standard variable overhead allowed for production/applied to production</b>	(SQ x SP)
<b>= <u>Variable overhead efficiency variance</u></b>	

The variable overhead efficiency variance is closely related to efficiency or inefficiency in the use of whatever allocation base is used to apply the variable overhead. For example, if variable overhead is applied on the basis of direct labor hours, the variable overhead efficiency variance will be unfavorable when the direct labor efficiency variance is unfavorable and vice versa.

The variable overhead efficiency variance calculation begins with budgeted variable overhead instead of actual variable overhead, but the budgeted cost per unit of input (SP) is multiplied by the amount of inputs (direct labor hours, machine hours, and so forth) **actually used**. Therefore, the interpretation of the variable overhead efficiency variance is the same as for other cost variances:

- A **positive** variance is an **unfavorable** variance because actual usage of the allocation base was **greater than** the amount allowed for the production that took place, and
- A **negative** variance is a **favorable** variance because actual usage of the allocation base was **less than** the amount allowed for the production that took place.

**Note:** The second line of this formula is the same as the second line of the total variable overhead formula. Also, the first line of this formula is the same as the second line of the previous formula. This illustrates the split of the total variance into the two sub-variances.

<sup>50</sup> The “P” in this formula represents a rate, not a price. It refers to the standard predetermined overhead application rate. We use the letter P in this formula to keep it the same as in the materials and labor variances, since the formulas are essentially the same.

The variable overhead efficiency variance is also calculated as follows:

$$\left( \frac{\text{Actual Quantity of VOH Allocation Base Used for Actual Output} - \text{Standard Quantity of VOH Allocation Base Allowed for Actual Output}}{\text{Base Allowed for Actual Output}} \right) \times \text{Standard Application Rate}$$

or

$$(\text{AQ} - \text{SQ}) \times \text{SP}$$

Because the variable overhead efficiency variance is related so closely to the usage of whatever activity measure is used to allocate variable overhead to production, management should carefully select the allocation base to be used. If variable overhead is applied using an activity measure that is not well correlated with the incurrence of variable manufacturing costs, the variable overhead efficiency variance will not provide useful information to management.

Furthermore, the person who is responsible for controlling the activity used to allocate the variable overhead (direct labor hours, machine hours, and so forth) should also be responsible for reporting on the variable overhead efficiency variance.

**Note:** This discussion is focused on standard costing. Under standard costing, overhead is applied to production on the basis of the amount of the allocation base **allowed** for the actual production. Under standard costing, a company will probably have both a Variable Overhead Spending Variance and a Variable Overhead Efficiency Variance. But if normal costing or extended normal costing is being used instead of standard costing, overhead would be applied based on the amount of the allocation base **actually used** for the actual units of output rather than on the standard amount allowed. Thus, if normal costing or extended normal costing is being used, we would use the AQ (Actual Quantity) for both the AQ and the SQ in the formula above. Thus, the variance formula under normal costing would become  $(\text{AQ} - \text{AQ}) \times \text{SP}$ , which would be zero. Therefore, if overhead is applied based on the amount of the allocation base **actually used** for the actual units of output rather than on the standard amount allowed, there will be no Variable Overhead Efficiency Variance.

Normal costing and extended normal costing are explained in Section D of these study materials.

## Fixed Overhead Variances

Fixed overheads are overhead costs that do not change in total as the level of production changes, as long as the production level remains within the relevant range. The best example of fixed overhead is factory rent, which cannot be traced to specific units manufactured and therefore is classified as an overhead cost. Because the rent payment is the same regardless of the factory's production level (as long as the production level remains within the maximum volume that can be produced on the premises), rent is a fixed cost.

### Total Fixed Overhead Variance

Fixed overhead costs are allocated to units produced using the predetermined fixed overhead rate. Therefore, the total fixed overhead variance is the difference between the actual fixed overhead incurred and the amount that was applied using the standard rate and the standard usage of the application base for the actual level of output.

$$\begin{aligned}
 & \text{Actual fixed overhead incurred (money actually spent)} \\
 & - \text{Standard fixed overhead applied (standard rate} \times \text{standard usage for actual output)}^{51} \\
 & = \text{Total fixed overhead variance}
 \end{aligned}$$

The Total Fixed Overhead Variance is interpreted the same way as for other cost variances:

- A **positive** variance is an **unfavorable** variance because actual fixed costs were **greater than** the amount of fixed costs allowed for the actual output, and
- A **negative** variance is a **favorable** variance because actual fixed costs were **less than** the amount of fixed costs allowed for the actual output.

**Note:** Again, the fixed overhead variance is the same as the amount of over- or under-applied fixed overhead.

- If the amount of fixed overhead applied is **less than** the actual fixed overhead incurred, fixed overhead is **under-applied**.
- If the amount of fixed overhead applied is **greater than** the actual fixed overhead incurred, fixed overhead is **over-applied**.

Over- and under-applied fixed factory overhead are covered in detail in Section D of these study materials.

As with the total variable overhead variance, the total fixed overhead variance can be broken down into two other variances: the spending (or budget) variance and the production-volume variance.

When the fixed overhead spending variance and the fixed overhead production-volume variance are combined, they will equal the total fixed overhead variance and the amount of over- or under-applied fixed overhead.

### 1) Fixed Overhead Spending (Flexible Budget) Variance

The fixed overhead spending variance, also called the flexible budget or the budget variance, is the difference between the actual fixed overhead costs incurred and the budgeted fixed overhead (flexible budget **and/or** static budget)<sup>52</sup> amount.

$$\begin{aligned}
 & \text{Actual Fixed Overhead Incurred} \\
 & - \text{Budgeted Fixed Overheads (the flexible budget OR the static budget amount)} \\
 & = \text{Fixed Overhead Spending/Flexible Budget Variance}
 \end{aligned}$$

<sup>51</sup> The "standard for actual output" in the formula is the **standard amount of the application base allowed for the actual output**.

<sup>52</sup> As long as production remains within the relevant range, budgeted fixed costs in the flexible budget will be the same as budgeted fixed costs in the static budget.

The cause of the Fixed Overhead Spending, or Fixed Overhead Flexible Budget/Spending Variance, is fixed factory overhead that is different from (either greater than or less than) the amount budgeted for it. The interpretation of the Fixed Overhead Budget/Spending Variance is the same as for other cost variances:

- A **positive** variance is an **unfavorable** variance because actual costs were **greater than** budgeted costs, and
- A **negative** variance is a **favorable** variance because actual costs were **less than** budgeted costs.

**Note:** The first line of this formula is the same as the first line of the total fixed overhead formula.

Also, the flexible budget and the static budget amounts are the same because fixed overhead is fixed and thus does not change with changes in production as long as production remains within the relevant range.

## 2) Fixed Overhead Production-Volume Variance

The fixed overhead production-volume variance is the difference between the budgeted amount of fixed overhead and the amount of fixed overhead applied (standard rate × **standard input for the actual level of output**). The Fixed Overhead Production-Volume Variance is caused by a difference between the actual production level and the production level used to calculate the budgeted fixed overhead rate.

**The fixed overhead production-volume variance has no connection to any actually incurred costs, so it is not a comparison between actual and budgeted costs in the way other variances are.** Instead, it is a measure of capacity utilization.

The fixed overhead production-volume variance is calculated as follows:

**Budgeted Fixed Overheads** (the flexible budget OR the static budget amount)

- **Standard fixed overhead applied** (standard rate × standard input for actual output)
- = **Fixed Overhead Production-Volume Variance**

**Note:** The second line of the Fixed Overhead Production-Volume Variance formula is the same as the second line of the Total Fixed Overhead formula. Also, the first line of the Fixed Overhead Production-Volume Variance formula is the same as the second line of the Fixed Overhead Flexible Budget/Spending Variance formula. This is how the total fixed overhead variance is split into two variances.

<b>Actual Fixed OH Incurred</b> – <b>Budgeted Fixed OH</b>	}	=	<b>FOH Flexible Budget/ Spending Variance</b>  + <b>FOH Production- Volume Variance</b>	}	=	<b>Total FOH Variance</b>
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Interpretation of whether the Fixed Overhead Production-Volume Variance is favorable or unfavorable is the same as for other cost variances, but this variance is calculated differently.

- A **negative amount** (applied fixed overhead is greater than budgeted fixed overhead) is **Favorable** because it indicates that actual production has **exceeded** the budgeted production level.
- A **positive amount** (budgeted fixed overhead is greater than applied fixed overhead) is **Unfavorable** because it indicates that actual production has been **lower** than the budgeted production level.

**Note:** This is the only time for a cost variance that a budgeted cost amount comes before an actual cost amount and yet a negative amount is Favorable. This variance is different because it does not measure a difference between an actual incurred cost and a budgeted cost.

**The Total Overhead *Flexible Budget* Variance**

Variances are used for different purposes. The Total Overhead Variance that we calculated above is the difference between total actual overhead incurred (fixed and variable) and the total amount of overhead applied (fixed and variable). The Total Overhead Variance is the sum of the overhead variances that arises in the accounting system when production is accounted for. These are the variances that are resolved at the end of the reporting period as part of the closing process. As we have seen, this total variance can be subdivided into four sub-variances.

However, the Total Overhead Variance does not indicate the difference between the actual overhead incurred and the flexible budget overhead. For the difference between actual overhead incurred and the flexible budget overhead, we need the **Total Overhead *Flexible Budget* Variance**. The Total Overhead *Flexible Budget* Variance includes these three of the four overhead sub-variances:

- 1) Variable Overhead Spending Variance.
- 2) Variable Overhead Efficiency Variance.
- 3) Fixed Overhead Spending Variance.

The Total Overhead *Flexible Budget* Variance **does not** include the Fixed Overhead Production-Volume Variance because the Fixed Overhead Production-Volume Variance is not a comparison between actual and budgeted costs as the other variances are.

The **total overhead flexible budget variance** is

$$\begin{aligned} & \text{Actual total variable and fixed overhead incurred (money spent on these items)} \\ & - \text{Total flexible budget variable and fixed overhead amounts for the actual output} \\ & = \text{Total Overhead Flexible Budget Variance} \end{aligned}$$

It is important to recognize that **the flexible budget amount for fixed overhead is exactly the same as the static budget amount for fixed overhead**, but the flexible budget amount for **variable** overhead will be an **adjusted amount** because it is the amount **allowed** for the actual output.

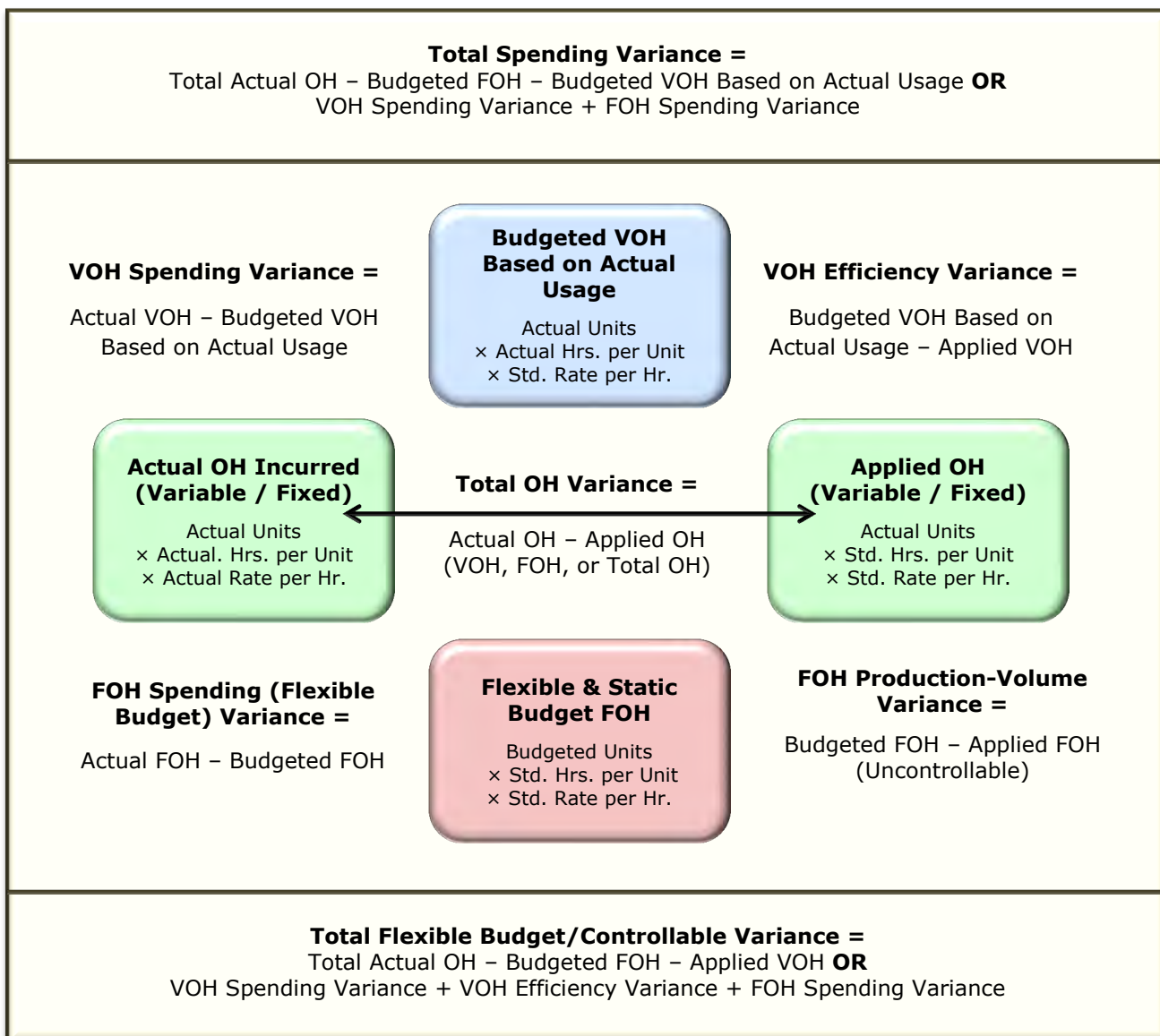
The variable overhead spending (budget) variance plus the variable overhead efficiency variance equals the total variable overhead variance. However, only the fixed overhead spending (budget) variance is included in the total overhead flexible budget variance.

To reiterate: The fixed overhead production-volume variance is omitted from the calculation of the total overhead flexible budget variance because it has no connection to any actually incurred costs, so it is not a comparison between actual and budgeted costs as the other sub-variances are.

**Note:** There is no fixed overhead efficiency variance because fixed costs do not relate to levels of output and therefore cannot be used either efficiently or inefficiently.

## Overhead Variances Graphic

The graphic below was developed by someone who was using the HOCK study materials to prepare for her CMA exams and graciously offered it for the assistance of our other students. Many thanks to Laura Zaverdinos.



Graphic created by Laura Zaverdinos, CPA, CMA, CLU, ChFC. Used by permission.

## Comprehensive Example of Overhead Variances

The following is a comprehensive example of variable, fixed, and total overhead variance calculations. In addition to this example, you will find a comprehensive example of accounting for fixed overhead and fixed overhead variances in Section D of this textbook under the topic of *The Process of Accounting for Factory Overhead*. The example in Section D highlights fixed overhead and shows how the fixed overhead variances arise in the accounting system and how they are cleared out. The fixed overhead example in Section D uses the same amounts as this example does for fixed overhead.

**Example:** In this example, we will calculate the following variances:

- 1) Total overhead variance
- 2) Total variable overhead variance
- 3) Variable overhead spending variance
- 4) Variable overhead efficiency variance
- 5) Total fixed overhead variance
- 6) Fixed overhead spending variance
- 7) Fixed overhead production-volume variance
- 8) Total overhead flexible budget variance

OPQ Company applies overhead to production based on machine hours. Before 20X0 begins, the company budgets the following for the year 20X0:

Standard for number of machine hours used/unit produced ..... 5 MH/unit  
 Budgeted activity level ..... 1,000,000 units  
 Budgeted fixed overhead ..... \$10,000,000  
 Budgeted fixed overhead application rate:  
 $\$10,000,000 \div (5 \text{ MH/unit} \times 1,000,000 \text{ units}) \dots\dots\dots \$2/\text{MH}$  (**also** \$10/unit)  
 Budgeted variable overhead for budgeted activity level ..... \$5,000,000  
 Budgeted variable overhead application rate:  
 $\$5,000,000 \div (5 \text{ MH/unit} \times 1,000,000 \text{ units}) \dots\dots\dots \$1/\text{MH}$  (**also** \$5/unit)

Actual overhead incurred during 20X0 was:

Variable overhead incurred	\$ 5,670,000
Fixed overhead incurred	<u>11,000,000</u>
Total overhead incurred	\$16,670,000

Actual production during 20X0 is 1,200,000 units. The **standard** number of machine hours (the machine hours **allowed** for the actual production) is 1,200,000 units  $\times$  5 MH per unit, or 6,000,000 machine hours. The **actual** number of machine hours used during 20X0 for the actual production is 6,300,000 hours.

During 20X0, fixed and variable overhead is applied to production at the predetermined rates of \$2 per machine hour **allowed** for fixed overhead and \$1 per machine hour **allowed** for variable overhead, for a total of \$3 per machine hour allowed. Since 6,000,000 machine hours were allowed for the actual production of 1,200,000 units, the total amount of fixed overhead applied is  $\$2 \times 6,000,000$ , or \$12,000,000; and the total amount of variable overhead applied is  $\$1 \times 6,000,000$ , or \$6,000,000. Total fixed and variable overhead applied is  $\$12,000,000 + \$6,000,000$ , or \$18,000,000.

### 1) Total Overhead Variance

**Actual overhead incurred** during 20X0 was:

Fixed overhead	\$11,000,000
Variable overhead	<u>5,670,000</u>
Total actual overhead incurred	\$16,670,000

**Applied overhead** for 20X0:

Fixed overhead ( $\$2/\text{MH} \times 5\text{MH/unit} \times 1,200,000 \text{ units produced}$ )	\$12,000,000
Variable overhead ( $\$1/\text{MH} \times 5\text{MH/unit} \times 1,200,000 \text{ units produced}$ )	<u>6,000,000</u>
Total flexible budget overhead, fixed and variable	\$18,000,000

Total overhead variance (total actual OH – total applied OH)	<b><u>\$(1,330,000)</u> Favorable</b>
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(Continued)

**Variable Overhead Variances****2) Total Variable OH Variance:**

Actual Total Variable OH incurred	\$5,670,000
Minus: VOH Applied: standard rate × standard qty. of application base (machine hours) allowed for actual output (\$1 × 5 × 1,200,000)	<u>6,000,000</u>
Equals: Total Variable Overhead Variance	<b><u>\$( 330,000)</u> Favorable</b>

The total variable overhead variance is broken down into the **variable overhead spending variance** and the **variable overhead efficiency variance**.

**3) Variable Overhead Spending Variance:**

Actual VOH incurred – Budgeted VOH based on actual usage =

$$\$5,670,000 - (6,300,000 \times \$1) = \mathbf{\$(630,000) \text{ Favorable}}$$

**OR**

$$\left[ \begin{array}{l} \text{Actual VOH cost/unit of allocation base actually used} \\ \text{Minus standard VOH application rate/unit of allocation base} \end{array} \right] \times \begin{array}{l} \text{Actual Qty. of VOH} \\ \text{application base used for} \\ \text{actual output} \end{array}$$

$$\text{OR } (AP - SP) \times AQ$$

$$[(\$5,670,000 \div 6,300,000) - \$1] \times 6,300,000 = (0.90 - 1.00) \times 6,300,000 = \mathbf{\$(630,000) \text{ Favorable}}$$

**4) Variable Overhead Efficiency Variance:**

Budgeted VOH based on actual usage – Variable OH applied to production =

$$(6,300,000 \times \$1) - (\$1 \times 5 \times 1,200,000) = \mathbf{\$300,000 \text{ Unfavorable}}$$

**OR**

$$\left[ \begin{array}{l} \text{Actual activity level of VOH application base **actually used**} \\ \text{Minus standard activity level of application base **allowed**} \end{array} \right] \times \text{Standard Application Rate}$$

$$\text{OR } (AQ - SQ) \times SP$$

$$[6,300,000 - (1,200,000 \times 5)] \times \$1 = (6,300,000 - 6,000,000) \times \$1 = \mathbf{\$300,000 \text{ Unfavorable}}$$

The Variable Overhead Spending Variance of \$(630,000) Favorable plus the Variable Overhead Efficiency Variance of \$300,000 Unfavorable equals the Total Variable Overhead Variance of \$(330,000) Favorable.

The variance analysis tells us that the actual variable overhead cost per unit of the allocation base (machine hours) incurred was lower than budgeted for the amount actually produced (\$630,000 Favorable), but the number of units of the allocation base (machine hours) actually used was higher than budgeted (\$300,000 Unfavorable). The net, or total, variable overhead variance is (630,000) + 300,000 = (330,000) Favorable.

**Fixed Overhead Variances****5) Total Fixed Overhead Variance:**

Actual fixed overhead incurred	\$11,000,000
Minus: Applied fixed overhead (standard rate × standard quantity of application base for actual output, or \$2 × 6,000,000 MH)	<u>12,000,000</u>
Equals: Total fixed overhead variance	<b><u>\$(1,000,000)</u> Favorable</b>

(Continued)



The total fixed overhead variance is broken down into the **fixed overhead spending variance** and the **fixed overhead production-volume variance**.

**6) Fixed Overhead Spending (Flexible Budget) Variance:**

Actual fixed overhead incurred	\$11,000,000	
Minus: Flexible & static budget fixed overhead	<u>10,000,000</u>	
Equals: Fixed overhead spending variance	<u><b>\$1,000,000</b></u>	<b>Unfavorable</b>

**7) Fixed Overhead Production-Volume Variance:**

Budgeted Fixed Overhead	\$10,000,000	
Minus: Applied fixed overhead (standard rate × standard quantity of application base for actual output, or \$2 × 6,000,000 MH)	<u>12,000,000</u>	
Equals: Fixed overhead production-volume variance	<u><b>\$(2,000,000)</b></u>	<b>Favorable</b>

The Total Fixed Overhead Variance is the total of the \$1,000,000 Unfavorable spending variance plus the \$2,000,000 Favorable production-volume variance, or \$1,000,000 Favorable.

- The unfavorable spending variance means more fixed overhead was actually incurred than was budgeted.
- The favorable production-volume variance means that actual production exceeded the budgeted production level.

The total variable overhead variance of \$(330,000) Favorable plus the total fixed overhead variance of \$(1,000,000) Favorable is equal to the total overhead variance we calculated at the beginning of this example of \$(1,330,000) Favorable.

**8) Total Overhead Flexible Budget Variance**

The Total Overhead Variance is the difference between total actual overhead incurred and total overhead applied. The Total Overhead Variance, calculated at the beginning of this example, is \$(1,330,000) Favorable.

The Total Overhead Flexible Budget Variance is the difference between total actual overhead incurred and the total flexible budget total overhead. The Total Overhead Flexible Budget Variance reveals something different. This total overhead variance is Unfavorable, not Favorable.

**Actual overhead incurred** during 20X0:

Fixed overhead	\$11,000,000
Variable overhead	<u>5,670,000</u>
Total actual overhead incurred	\$16,670,000

**Budgeted overhead** for 20X0 (**flexible** budget):

Budgeted fixed overhead (flexible and static budget amount)	\$10,000,000
Flexible budget variable overhead (\$1/MH × 5MH/unit × 1,200,000 units produced)	<u>6,000,000</u>
Total flexible budget overhead, fixed and variable	\$16,000,000

Total overhead flexible budget variance (total actual overhead incurred minus total flexible budget overhead)	<u><b>\$ 670,000</b></u>	<b>Unfavorable</b>
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(Continued)

The total overhead flexible budget variance is made up of the variable overhead spending variance, the variable overhead efficiency variance, and the fixed overhead spending variance, all of which are calculated in this example. They are:

Variable overhead spending variance	\$(630,000)	Favorable
Variable overhead efficiency variance	300,000	Unfavorable
Fixed overhead spending variance	<u>1,000,000</u>	Unfavorable
Total overhead flexible budget variance	<b><u>\$ 670,000</u></b>	<b>Unfavorable</b>

- The Total Overhead Variance is \$(1,330,000) Favorable.
- The Total Overhead Flexible Budget Variance is \$670,000 Unfavorable.

Why are these two total overhead variances so different? The difference is in the fixed overhead production-volume variance, which is included in the Total Overhead Variance and not included in the Total Overhead Flexible Budget Variance. The fixed overhead production-volume variance was \$(2,000,000) Favorable. When we omit that variance, the Total Overhead Variance changes from \$(1,330,000) Favorable to the Total Overhead Flexible Budget variance of \$670,000 Unfavorable. The Fixed Overhead Production-Volume variance was favorable because production exceeded expectations (1,200,000 units produced versus 1,000,000 units budgeted), which generally is a good thing because it means the fixed production facilities were being utilized to a greater degree than the company had expected. When fixed production facilities are used to a greater degree, the fixed cost of each unit produced decreases.

However, total actual fixed costs exceeded the amount budgeted by \$1,000,000. Therefore, the amount of fixed cost of each unit may not have decreased after all. Did actual fixed costs increase because production was so great that the fixed cost moved out of the relevant range? That question is something that needs to be investigated, and it may be that the predetermined or standard application rate for fixed costs needs to be adjusted.

Question 123: Variable overhead is applied on the basis of standard direct labor hours. If the direct labor efficiency variance is unfavorable, the variable overhead efficiency variance will be:

- Favorable.
- Unfavorable.
- The same amount as the labor efficiency variance.
- Indeterminable because it is not related to the labor efficiency variance.

(CMA Adapted)

Question 124: The JoyT Company manufactures Maxi Dolls for sale in toy stores. In planning for this year, JoyT estimated variable factory overhead of \$600,000 and fixed factory overhead of \$400,000. JoyT uses a standard costing system, and factory overhead is allocated to units produced on the basis of standard direct labor hours. The denominator level of activity budgeted for this year was 10,000 direct labor hours, and JoyT used 10,300 actual direct labor hours.

Based on the output accomplished during the year, 9,900 standard direct labor hours should have been used. Actual variable factory overhead was \$596,000, and actual fixed factory overhead was \$410,000 for the year. Based on this information, the volume variance for JoyT for this year is

- \$4,000 unfavorable
- \$6,000 unfavorable
- \$10,000 unfavorable
- \$16,000 unfavorable

(ICMA 2010)

Question 125: The total fixed overhead variance is the:

- a) Measure of the lost profits from the lack of sales volume.
- b) Amount of the under-applied or over-applied fixed overhead costs.
- c) Potential cost reduction that can be achieved from better cost control.
- d) Measure of production inefficiency.

(CMA Adapted)

### Two-Way, Three-Way, and Four-Way Analysis of Overhead

We have covered the analysis of overheads (fixed and variable) in the four-way method. There are four overhead variances and each is calculated and reported separately. There are also three-way and two-way methods of analyzing overheads, which are done by combining some of the four-way analysis variances that we calculated.

In **Three-Way Analysis**, the three variances are the volume, efficiency, and spending variances.

- 1) The **volume variance** is equal to the production-volume variance as calculated for fixed overhead.
- 2) The **efficiency variance** is equal to the variable overhead efficiency variance.
- 3) The **spending variance** is equal to the variable overhead spending variance **plus** the fixed overhead spending variance.

**Two-Way Analysis** uses the same information as calculated for four-way analysis, but we are going to combine it in a slightly different manner than we do under Three-Way Analysis. The two variances involved are called the volume variance and the controllable (or budget) variance.

- 1) The **volume variance** is equal to the production-volume variance for fixed overhead.
- 2) The **controllable variance** is equal to the sum of the remaining three variances, which are the variable spending variance, variable efficiency variance, and fixed spending variance.

**Note:** The controllable variance is the total overhead flexible budget variance.

The following table illustrates the way the four variances are combined for three-way and two-way analysis.

	Variable Overhead Variance Analysis		Fixed Overhead Variance Analysis	
Four-Way	<b>Efficiency</b> Variance $(AQ - SQ) \times SP$	<b>Spending</b> Variance $(AP - SP) \times AQ$	<b>Spending</b> Variance Actual – Budgeted	<b>Production-Volume</b> Variance Budgeted – Applied
Three-Way	<b>Efficiency</b> Variance	<b>Spending</b> Variance		<b>Volume</b> Variance
Two-Way	<b>Controllable</b> Variance			<b>Volume</b> Variance

In the example above for OPQ Company, we did the four-way analysis first. We actually did the Controllable Variance part of the two-way analysis second, when we calculated the Total Overhead Flexible Budget Variance.

**Two-Way Overhead Variance Analysis****Variance #1: The Controllable Variance**

The Controllable Variance in two-way analysis is the same as the Total Overhead Flexible Budget Variance that we calculated in the OPQ Company example. In that example, the Total Overhead Flexible Budget Variance included the Variable Overhead Spending Variance, the Variable Overhead Efficiency Variance, and the Fixed Overhead Spending Variance. The Controllable Variance is the same number. The Controllable Variance can be calculated either by summing those other three variances or by calculating it directly as:

$$\begin{aligned}
 & \text{Total Actual Overhead Incurred} \\
 & - \text{Budgeted Fixed Overhead (static and flexible)} \\
 & - \text{Flexible Budget Variable Overhead (or variable overhead applied to production)} \\
 & = \text{Controllable Variance}
 \end{aligned}$$

For OPQ Company the Controllable Variance is:

$$\begin{aligned}
 & \$16,670,000 \quad \text{Total Actual Overhead Incurred} \\
 & - \quad 10,000,000 \quad \text{Budgeted Fixed Overhead (static and flexible)} \\
 & - \quad \underline{6,000,000} \quad \text{Variable OH Applied: } \$1/\text{MH} \times 5\text{MH/unit} \times 1,200,000 \text{ units produced} \\
 & = \underline{\$ \quad 670,000} \quad \text{Unfavorable Controllable Variance}
 \end{aligned}$$

Note that \$670,000 Unfavorable is also the Total Overhead Flexible Budget Variance that we calculated for OPQ Company.

**Variance #2: The Fixed Overhead Volume Variance**

The Fixed Overhead Volume Variance in two-way analysis is the same as the Fixed Overhead Production-Volume Variance in four-way analysis. For OPQ Company, it is \$(2,000,000) Favorable, calculated as:

$$\begin{aligned}
 & \text{Budgeted Fixed Overhead} && \$10,000,000 \\
 \text{Minus:} & \text{Applied fixed overhead (standard rate} \times \text{standard quantity of} \\
 & \text{application base for actual output, or } \$2 \times 6,000,000 \text{ MH)} && \underline{12,000,000} \\
 \text{Equals:} & \text{Fixed Overhead Volume Variance} && \underline{\$(2,000,000)} \quad \text{Favorable}
 \end{aligned}$$

**Reconciling to the Total Overhead Variance:**

$$\begin{aligned}
 & \text{Controllable Variance} && \$ \quad 670,000 \\
 & \text{Fixed Overhead Volume Variance} && \underline{(2,000,000)} \\
 & \text{Total Overhead Variance} && \underline{\$(1,330,000)} \quad \text{Favorable}
 \end{aligned}$$

### Three-Way Overhead Variance Analysis

#### Variance #1: The Total Spending Variance

In three-way overhead variance analysis, the Variable Overhead Spending Variance and the Fixed Overhead Spending Variance are combined into one Spending Variance.

The total Spending Variance (fixed and variable) can be calculated by combining those two variances, or it can be calculated directly as:

$$\begin{aligned}
 &\textbf{Actual Total Overhead Incurred} \\
 &- \textbf{Budgeted Fixed Overhead (static and flexible budget)} \\
 &- \textbf{Budgeted Variable Overhead based on actual usage of the allocation base} \\
 &= \textbf{Total Spending Variance}
 \end{aligned}$$

For OPQ Company, the Total Spending Variance is:

$$\begin{aligned}
 &\$16,670,000 \quad (\text{Actual Total Overhead Incurred}) \\
 &- \quad 10,000,000 \quad (\text{Budgeted fixed overhead}) \\
 &- \quad \underline{6,300,000} \quad (6,300,000 \text{ actual machine hours used} \times \$1/\text{MH}) \\
 &= \underline{\underline{\$ \quad 370,000}} \quad \textbf{Unfavorable}
 \end{aligned}$$

The same variance calculated by combining the Variable Overhead Spending Variance and the Fixed Overhead Spending Variance for OPQ Company is:

Variable Overhead Spending Variance	\$( 630,000)	Favorable
Fixed Overhead Spending Variance	<u>1,000,000</u>	Unfavorable
<b>Spending Variance</b>	<b><u>\$ 370,000</u></b>	<b>Unfavorable</b>

#### Variances #2 and 3: The Variable Overhead Efficiency Variance and The Fixed Overhead Volume Variance

In three-way overhead analysis, the Variable Overhead Efficiency Variance and the Fixed Overhead Volume Variance are the same as in four-way analysis. Both of these variances are calculated as they are for four-way variance analysis.

#### Variance #2: The Variable Overhead Efficiency Variance

For OPQ, the Variable Overhead Spending Variance is:

Budgeted VOH based on actual usage – Variable OH applied to production =

$$(6,300,000 \times \$1) - (\$1 \times 5 \times 1,200,000) = \textbf{\$300,000 Unfavorable}$$

**OR**

$$\left[ \begin{array}{l} \text{Actual activity level of VOH application base } \textbf{actually used} \\ \text{Minus standard activity level of application base } \textbf{allowed} \end{array} \right] \times \text{Standard Application Rate}$$

$$\text{OR} \quad (AQ - SQ) \times SP$$

$$[6,300,000 - (1,200,000 \times 5)] \times \$1 = (6,300,000 - 6,000,000) \times \$1 = \underline{\underline{\$300,000 \text{ Unfavorable}}}$$

(Continued)

**Variance #3: The Fixed Overhead Volume Variance** is calculated the same way as the Fixed Overhead Production-Volume Variance is calculated in four-way analysis.

For OPQ, the Fixed Overhead Volume Variance is:

	Budgeted Fixed Overhead	\$10,000,000	
Minus:	Applied fixed overhead (standard rate × standard quantity of application base for actual output, or \$2 × 6,000,000 MH)	<u>12,000,000</u>	
Equals:	Fixed Overhead Volume Variance	<u><b>\$(2,000,000)</b></u>	<b>Favorable</b>

**Reconciliation to the Total Overhead Variance:**

	Spending Variance	\$ 370,000	Unfavorable
Plus:	Variable Overhead Efficiency Variance	300,000	Unfavorable
Minus:	Fixed Overhead Volume Variance	<u>(2,000,000)</u>	Favorable
Equals:	Total Overhead Variance	<u><b>\$(1,330,000)</b></u>	<b>Favorable</b>

Question 126: Which of these variances is least significant for cost control?

- a) Labor price variance.
- b) Materials quantity variance.
- c) Fixed O/H volume variance.
- d) Variable O/H spending variance.

(CMA Adapted)

**The following information is for the next six questions:** Franklin Glass Works' production budget for the year ended November 30 was based on 200,000 units. Each unit required two standard hours of labor for completion. Total overhead was budgeted at \$900,000 for the year, and the fixed overhead rate was estimated at \$3.00 per unit. Both fixed and variable overhead are assigned to the product on the basis of direct labor hours. The actual data for the year ended November 30 is presented as follows:

Actual production in units	198,000
Actual direct labor hours	440,000
Actual variable overhead	\$352,000
Actual fixed overhead	\$575,000

Question 127: The standard hours allowed for actual production for the year ended November 30 total:

- a) 247,500
- b) 396,000
- c) 400,000
- d) 495,000

Question 128: Franklin's variable overhead efficiency variance for the year is:

- a) \$33,000 unfavorable.
- b) \$35,520 favorable.
- c) \$66,000 unfavorable.
- d) \$33,000 favorable.

Question 129: Franklin's variable overhead spending variance for the year is:

- a) \$20,000 unfavorable.
- b) \$19,800 favorable.
- c) \$22,000 unfavorable.
- d) \$20,000 favorable.

Question 130: Franklin's fixed overhead spending variance for the year is:

- a) \$19,000 favorable.
- b) \$25,000 favorable.
- c) \$5,750 favorable.
- d) \$25,000 unfavorable.

Question 131: The fixed overhead applied to Franklin's production for the year is:

- a) \$484,200.
- b) \$575,000.
- c) \$594,000.
- d) \$600,000.

Question 132: Franklin's fixed overhead volume variance for the year is:


- a) \$6,000 unfavorable.
- b) \$19,000 favorable.
- c) \$25,000 favorable.
- d) \$55,000 unfavorable.

(CMA Adapted)

## Summary Table of Manufacturing Variance Calculations

The following table summarizes the calculations that are made and the different terms used in variance analysis.

Prime Costs	Price Variance $(AP - SP) \times AQ$	Quantity Variance $(AQ - SQ) \times SP$
Materials	Price Variance	Quantity Variance
Labor	Rate Variance	Efficiency Variance



Multiple Inputs (both Material and Labor)	Mix Variance $(waspAM - waspSM) \times AQ$	Yield Variance $(AQ - SQ) \times waspSM$
--	---	---

Variable Overhead	Spending Variance $(AP - SP) \times AQ$	Efficiency Variance $(AQ - SQ) \times SP$
Fixed Overhead	Spending (Flexible Budget) Variance Actual OH – Budgeted OH	Production Volume Variance Budgeted OH – Applied OH

## Comprehensive Example of All Manufacturing Variances for OPQ Company

This example uses the OPQ Company facts from the overhead variances example a few pages back but we will add direct materials and direct labor variances and will reconcile the total variances figure to the individual variances.

- Standard costing is being used.
- The standard number of machine hours allowed per unit = 5.
- The standard number of units of direct materials allowed per unit manufactured = 6.
- The standard cost per unit of direct materials used = \$3.
- The standard number of direct labor hours allowed per unit = 2 hours.
- The standard cost per hour of direct labor = \$20 per hour.
- Overhead is applied based on machine hours.
- Budgeted production for the period is 1,000,000 units.
- Budgeted fixed overhead for the budgeted production of 1,000,000 units is \$10,000,000, and the predetermined fixed overhead rate is \$10 per unit or \$2 per machine hour since 5 machine hours are allowed per unit manufactured.
- Budgeted variable overhead for the budgeted production of 1,000,000 units is \$5,000,000, or \$5 per unit or \$1 per machine hour allowed per unit manufactured.
- Actual production is 1,200,000 units.
- Actual direct materials used for the actual production is 8,000,000 units at an actual cost of \$2.50 per unit of direct materials.
- Actual direct labor used for the actual production is 2,300,000 hours at an actual cost of \$21 per hour.
- Actual fixed overhead incurred = \$11,000,000.
- Actual variable overhead incurred for the actual production = \$5,670,000.
- Actual number of machine hours used for the actual production = 6,300,000 hours.

(Continued)



**Direct Materials Variances:**

<i>Price Variance:</i>	$(AP - SP) \times AQ$ $(\$2.50 - \$3.00) \times 8,000,000 =$	<b>\$(4,000,000)</b>	<b>F</b>
<i>Quantity Variance:</i>	$(AQ - SQ) \times SP$ $(8,000,000 - 7,200,000) \times \$3 =$	<b>\$ 2,400,000</b>	<b>U</b>

**Direct Labor Variances:**

<i>Rate Variance:</i>	$(AP - SP) \times AQ$ $(\$21 - \$20) \times 2,300,000 =$	<b>\$ 2,300,000</b>	<b>U</b>
<i>Efficiency Variance:</i>	$(AQ - SQ) \times SP$ $(2,300,000 - 2,400,000) \times \$20 =$	<b>\$(2,000,000)</b>	<b>F</b>

**Variable Overhead Variances:**

<i>Spending Variance:</i>	$(AP - SP) \times AQ$ AP = \$5,670,000 ÷ 6,300,000 = \$0.90 per machine hour SP = \$5,000,000 ÷ (5 MH per unit × 1,000,000 units) = \$1.00 per MH AQ = 6,300,000 MH $(\$0.90 - \$1.00) \times 6,300,000 =$	<b>\$ (630,000)</b>	<b>F</b>
<i>Efficiency Variance:</i>	$(AQ - SQ) \times SP$ SQ = 1,200,000 units produced × 5 MH/unit = 6,000,000 MH allowed $(6,300,000 - 6,000,000) \times \$1 =$	<b>\$ 300,000</b>	<b>U</b>

**Fixed Overhead Variances:**

<i>Spending (Flexible Budget) Variance:</i>	Actual FOH Cost Incurred – Flexible/Static Budget FOH $\$11,000,000 - \$10,000,000 =$	<b>\$ 1,000,000</b>	<b>U</b>
<i>Production-Volume Variance:</i>	Flexible/Static Budget FOH – FOH Applied $\$10,000,000 - \$12,000,000 =$	<b><u>\$(2,000,000)</u></b>	<b>F</b>
<b>Total Variance</b>		<b><u>\$(2,630,000)</u></b>	<b>F</b>

**Reconciliation of Total Variance to Actual Costs Minus Applied Costs****Actual Costs:**

Direct Material (\$2.50 × 8,000,000 units)	\$ 20,000,000
Direct Labor (\$21 × 2,300,000)	48,300,000
Variable Overhead	5,670,000
Fixed Overhead	<u>11,000,000</u>
Total Actual Costs	\$ 84,970,000

**Applied Costs:**

Direct Material (\$3 × 1,200,000 units × 6 units DM/unit)	\$ 21,600,000
Direct Labor (\$20/hr. × 1,200,000 units × 2 hrs. DL per unit)	48,000,000
Variable Overhead (\$1 per MH × 1,200,000 units × 5 MH/unit)	6,000,000
Fixed Overhead (\$2 per MH × 1,200,000 units × 5 MH/unit)	<u>12,000,000</u>
Total Applied Costs	\$ 87,600,000

Total Variance (Actual Costs Minus Applied Costs)	<b><u>\$(2,630,000)</u></b>	<b>F</b>
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This Total Variance is equal to the Total Variance calculated on the previous page. This is a favorable variance because it cost less than expected to produce the actual output based on the standard costs of the company.

If all the costs have been accounted for properly, the standard costs as applied to production during the period combined with the variances will reconcile to the actual, incurred costs. To do this reconciliation, adjust the applied costs by the amounts of the variances. Maintain the same "signs" as the signs for the calculated variances. In other words, subtract favorable variances from the applied costs and add unfavorable variances to the applied costs. The result should be equal to the actual, incurred costs. This reconciliation follows for OPQ Company.

**Reconciliation of costs applied to production to actual, incurred costs for OPQ Company:**

Standard variable costs applied to production as calculated on the preceding page:

Direct materials: $1,200,000 \times 6 \times \$3$	\$21,600,000
Direct labor: $1,200,000 \times 2 \times \$20$	48,000,000
Variable overhead: $1,200,000 \times 5 \times \$1$	<u>6,000,000</u>

Total standard variable costs applied to production	\$ 75,600,000
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Fixed Overhead applied to production: $1,200,000 \times 5 \times \$2$	<u>12,000,000</u>
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Total costs applied to production	\$ 87,600,000
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Variances as calculated on the preceding page:

Direct Material Price Variance	\$ (4,000,000)	F
Direct Material Quantity Variance	2,400,000	U
Direct Labor Rate Variance	2,300,000	U
Direct Labor Efficiency Variance	(2,000,000)	F
Variable Overhead Spending Variance	(630,000)	F
Variable Overhead Efficiency Variance	300,000	U
Fixed Overhead Spending Variance	1,000,000	U
Fixed Overhead Volume Variance	<u>(2,000,000)</u>	F

Actual costs incurred	\$ 84,970,000
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**Reconciliation to total costs incurred:**

Direct Materials: $8,000,000 \text{ units} \times \$2.50$	\$ 20,000,000
Direct Labor: $2,300,000 \text{ hours} \times \$21$	48,300,000
Variable Overhead incurred	5,670,000
Fixed Overhead incurred	<u>11,000,000</u>

Total costs incurred	\$ 84,970,000
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Difference	<u>\$ 0</u>
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## Sales Variances

Earlier in this discussion, we presented a Sales Variance Report. We now return to sales variances and cover them in more detail.

Variance analysis can be used to assess the selling department as well as the production department. We know logically that when actual revenue is different from budgeted revenue it is because we either sold more or less than we expected or because the selling price was higher or lower than expected, or both.

Sales variances are used to explain the differences between actual and budgeted amounts of revenue, variable costs, and the contribution margin. Revenues, variable costs, and the contribution are the line items that are most affected by the changes in the amount of each product that is sold, the price each unit is sold for, and the cost of each unit sold.

The variances can be caused by differences in sales price charged, by differences in volume of sales, by differences in variable cost per unit, and by differences in the mix of products sold.

These variances are called **sales variances** to differentiate them from the manufacturing input variances we talked about in the previous topic, but we could also call them "income statement variances" because they are based on the income statement and thus on the amount **sold**. In contrast, manufacturing input variances are based on the amount **produced**.

These variances can be calculated for every variable line on the sales variance report, not just for the Revenue line.

Sales variances are broken down between Flexible Budget Variances and Sales Volume Variances.

- The difference between the Actual and the Flexible Budget is the **Flexible Budget Variance**.
- The difference between the Actual and the Static Budget is the **Static Budget Variance**.
- The Flexible Budget Variance plus the Sales Volume Variance equals the Static Budget Variance.

### Flexible Budget Variances on a Sales Variance Report

Flexible Budget Variances on a Sales Variance Report can be calculated in the same way as manufacturing input Price Variances (the Direct Materials Price Variance and the Labor Rate Variance) are calculated:

$$(AP - SP) \times AQ$$

In the formula above, the "AP" stands for the actual average revenue or cost per item sold, the "SP" stands for the budgeted average revenue or cost per item sold, and the "AQ" stands for the actual number of units sold.

These variances, however, are not interpreted the same way as manufacturing input Price Variances are interpreted. The manufacturing input Price Variance measures the portion of the Flexible Budget Variance for units produced that was due to a difference between the actual and the standard price per unit of the **input**. When manufacturing input variances are being calculated, the Price Variance formula is used to calculate only one part of the manufacturing input flexible budget variance: the price variance. The other part of the manufacturing input Flexible Budget Variance is the quantity variance, which measures how much of the manufacturing input Flexible Budget Variance is due to a difference between the actual amount of the input used and the standard amount allowed.

When sales variances are calculated for cost items, however, this formula represents the **whole** flexible budget variance for the units sold, including both the price and the quantity variances for manufacturing inputs. The amount of materials, direct labor, or (in the case of overhead that is applied on the basis of machine hours) machine hours used in producing the products that were sold may have been different from the amount allowed for the actual output, and the prices paid per unit of those inputs may have been different. But there is no way to decompose the Flexible Budget Variance for a cost on a Sales Variance report into manufacturing price and manufacturing quantity variances for the units sold. None of the costs are broken down according to the price and quantity variances that we calculated in the manufacturing input

variances section. They cannot be broken down that way on a Sales Variance Report because the information required to do so is not available on the report or in the backup to the report.

Furthermore, the Flexible Budget Variance on a Sales Variance report cannot be reconciled to the total manufacturing input Flexible Budget Variance for the same period because manufacturing input variances are for units **produced**, whereas sales variances are for units **sold**. The quantities will always be different because the number of units produced is not the same as the number of units sold. The average cost per unit sold may be different from the average cost per unit produced because some of the units sold may have been drawn from beginning inventory and thus were produced during an earlier period, possibly at a different cost.

### **Sales Volume Variances on a Sales Variance Report**

The Sales Volume Variances on a Sales Variance Report represent the variances caused by the number of units sold having been different from the number of units budgeted to be sold. The Sales Volume Variance can be calculated using the same formula that is used for manufacturing input Quantity Variances, where the "AQ" stands for the actual quantity sold, "SQ" stands for the static budget quantity budgeted to be sold, and "SP" stands for the budgeted average price per unit (for revenue) or average variable cost per unit (for variable costs):

$$(AQ - SQ) \times SP$$

To illustrate sales variances, we return to the variance analysis report example from the beginning of this topic. The amounts on the following report are the numbers from the first variance report in this topic, not the numbers from the comprehensive example for OPQ Company that we used to illustrate the individual manufacturing variances in a total variances report.

Flexible Budget Variances on a Sales Variance Report are calculated in different ways depending upon whether the company sells one product or more than one product. We will begin with a company selling just one product.

<b>Variance Report for a Single Product Company</b>						
	<u>Col. 1</u>	<u>Col. 2</u>	<u>Col. 3</u>	<u>Col. 4</u>	<u>Col. 5</u>	<u>Col. 6</u>
		(2)=(1)-(3)		(4)=(3)-(5)		(6)=(1)-(5) also (6)=(2)+(4)
	<u>Actual Results</u>	<u>Flexible Budget Variances</u>	<u>Flexible Budget</u>	<u>Sales Volume Variances</u>	<u>Static Budget</u>	<u>Static Budget Variances</u>
Units sold	20,000	0	20,000	4,000– U	24,000	4,000– U
Revenues	\$2,500,000	\$100,000+ F	\$2,400,000	\$480,000– U	\$2,880,000	\$380,000– U
Variable costs:						
Direct materials	1,243,200	43,200+ U	1,200,000	240,000– F	1,440,000	196,800– F
Direct manufacturing labor	396,000	76,000+ U	320,000	64,000– F	384,000	12,000+ U
Variable manufacturing overhead	<u>261,000</u>	<u>21,000+ U</u>	<u>240,000</u>	<u>48,000– F</u>	<u>288,000</u>	<u>27,000– F</u>
Total variable costs	<u>\$1,900,200</u>	<u>\$140,200+ U</u>	<u>\$1,760,000</u>	<u>\$352,000– F</u>	<u>\$2,112,000</u>	<u>\$211,800– F</u>
Contribution margin	\$ 599,800	\$ 40,200– U	\$ 640,000	\$128,000– U	\$ 768,000	\$168,200– U
Fixed costs	<u>570,000</u>	<u>18,000+ U</u>	<u>552,000</u>	<u>0</u>	<u>552,000</u>	<u>18,000+ U</u>
Operating income	<u>\$ 29,800</u>	<u>\$ 58,200– U</u>	<u>\$ 88,000</u>	<u>\$128,000– U</u>	<u>\$ 216,000</u>	<u>\$186,200– U</u>
		<b>\$58,200–U</b>		<b>\$128,000–U</b>		
		<b>Total flexible budget variance</b>		<b>Total sales volume variance</b>		
						<b>\$186,200 U</b>
						<b>Total static budget variance</b>

Since this company sells only one product, we have calculated the Flexible Budget column by taking the Static Budget amount, dividing the variable revenue and cost items by the Static Budget units sold, and multiplying by the Actual Results units sold. The Flexible Budget is what the budget would have been at the beginning of the year if the budget had been prepared using the actual level of sales. This means that the total revenue and variable costs will be different in the flexible budget than in the static budget, but total fixed costs will be the same in both budgets.

In the variance report above, the Flexible Budget Revenue is \$2,400,000, calculated by dividing the Static Budget Revenue of \$2,880,000 by the 24,000 units sold in the Static Budget and multiplying the result by the 20,000 actual number of units sold. Each variable cost line is calculated the same way, and the Contribution Margin line can also be calculated the same way. (**Note:** The Flexible Budget can be calculated in this manner **only** when the company sells a single product, as we shall see later.)

### Selling Price Variance

The Flexible Budget Variance for the Revenue line on a variance report (such as the one above) is a special class of Flexible Budget Variance called the Selling Price, or Sales Price, Variance. For the Revenue line, the Selling Price Variance is the same as the Flexible Budget Variance. It is called the Selling Price Variance (instead of Sales Price Variance) throughout this discussion to distinguish it from Sales Variances, which refer to any line on the income statement variance report or sales variance report.

**Exam Tip:** Although we will use the term "Selling Price Variance" throughout this discussion, an exam question might use the term "Sales Price Variance" to refer to the same idea.

#### Points to remember:

- **Sales Variances** are all the variances on a Sales Variance Report.
- A Sales Variance Report is based on an income statement, on revenues and expenses for the volume of goods **sold** compared with budgeted revenues and expenses.
- The **Selling Price Variance** (also called the Sales Price Variance) on a Sales Variance Report is the Flexible Budget Variance for the Revenue line **only**.

These distinctions will become clearer as this discussion unfolds, but it is important to remember the difference between Sales Variances and the Selling (or Sales) Price Variance.

### Sales Variances for a Single Product Firm

#### Flexible Budget Variances for a Single Product Firm

The Flexible Budget Variance for each line on the Variance Report is the difference between the Actual Results and the Flexible Budget amount. For example, in the Sales Variance Report above, the Flexible Budget Variance for revenue is **\$2,500,000 – \$2,400,000, or \$100,000 F**.

The Flexible Budget Variance can also be calculated using the Price Variance formula:

$$(\text{AP} - \text{SP}) \times \text{AQ}$$

Thus, the Flexible Budget Variance for revenues (also called the Selling Price Variance, since this is the revenue line) on the variance report above can also be calculated as:

$$(\$125 - \$120) \times 20,000 = \$100,000 \text{ F}$$

The \$125 figure used for "**AP**" is the actual average selling price per unit (\$2,500,000 revenue divided by 20,000 units sold), and the \$120 used for "**SP**" is the budgeted average selling price per unit. The budgeted average selling price per unit can be calculated using the Flexible Budget figures (\$2,400,000 ÷ 20,000) or the Static Budget figures (\$2,880,000 ÷ 24,000).

The \$100,000 favorable variance (calculated above) is the same as the Flexible Budget Variance for the revenue line calculated on the Variance Report. The variance is a positive amount, and a positive variance for a revenue item is a favorable variance because the actual revenue was greater than the budgeted revenue.

For the direct materials line, the Flexible Budget Variance as calculated on the Variance Report is **\$1,243,200 – \$1,200,000 = \$43,000 U**.

To use the variance formula  $(AP - SP) \times AQ$  to calculate the direct materials flexible budget variance, we need to calculate the actual and flexible budget average per unit costs:

- The "**AP**" is \$62.16 per unit, calculated by dividing actual direct materials cost (\$1,243,200) by actual units sold (20,000 units).
- The "**SP**" is \$60.00 per unit, and this can be calculated either in the Flexible Budget column or in the Static Budget column on the report by dividing the budgeted cost in the column by the budgeted number of units to be sold. The budgeted cost per unit will be the same whether it is calculated using the Flexible Budget column ( $\$1,200,000 \div 20,000$ ) or the Static Budget column ( $\$2,440,000 \div 24,000$ ).
- The "**AQ**" is 20,000 units.

Therefore, the Flexible Budget Variance for the direct materials line is:

$$(\$62.16 - \$60.00) \times 20,000 = \$43,200 \text{ U}$$

The variance calculated using the variance formula  $(AP - SP) \times AQ$  is the same as the Flexible Budget Variance for the Direct Materials line on the variance report. It is Unfavorable because it is positive, and a positive variance for a cost is an unfavorable variance because it means the actual cost was greater than the budgeted cost.

You may want to practice calculating the Flexible Budget Variances in this same way for the other variable cost lines on the Variance Report.

### Sales Volume Variances for a Single Product Firm

The sales volume variances on a sales variance report measure the impact of the difference in sales volume on the difference between the **actual results** and the **static budget**. For each line, the sales volume variance is the **portion** of the static budget variance that is attributable to a difference between the actual sales volume and the forecasted sales volume used to develop the static budget.

**Note:** If a static budget is not used for variance reporting and **only a flexible budget is used** to make the comparisons to actual results, there will be **no sales volume variance** because the actual units sold will be equal to the units budgeted to be sold according to the flexible budget. The flexible budget adjusts the budgeted revenues and costs to reflect the actual volume. There can be a sales volume variance on a sales variance report only when the actual results are compared to the static budget.

In the Variance Report above, there is a column called "Sales Volume Variances" and another called "Static Budget Variances" in addition to the column "Flexible Budget Variances."

The Sales Volume Variance measures the difference between the Static Budget amount and the Flexible Budget amount for each line. For example, the Static Budget amount for revenues is \$2,880,000, based on sales of 24,000 units at \$120. However, only 20,000 units were actually sold and the actual selling price was \$125 instead of \$120.

The Sales Volume Variance for revenue on the above variance report is the difference between the Static Budget Variance of \$(380,000) and the Flexible Budget Variance of \$100,000, or **\$(380,000) - \$100,000 = \$(480,000) Unfavorable**. Because this is a revenue line, a negative variance is unfavorable.

The Sales Volume Variance is also the difference between the Flexible Budget amount (\$2,400,000 for the revenue line) and the Static Budget amount (\$2,880,000 for the revenue line), which also equals \$(480,000) Unfavorable.

For a single product firm, the Sales Volume Variance can also be calculated for each variable income and expense item (and the contribution margin) on the variance report using the general Quantity Variance formula:

$$(AQ - SQ) \times SP$$

Using the average budgeted revenue per unit as the "SP," we can calculate the **Sales Volume Variance for revenue**:

$$(20,000 - 24,000) \times \$120 = \$ (480,000) \text{ U}$$

This is the same amount as the Sales Volume Variance for revenue on the Sales Variance Report. Since this is a revenue item, a negative variance is an Unfavorable variance because it means the revenue was less than budgeted.

On the variance report, the **Static Budget Variance** for revenue is \$(380,000) Unfavorable. This Static Budget Variance is composed of the \$100,000 Favorable Flexible Budget Variance and the \$(480,000) Unfavorable Sales Volume Variance. The actual price received for the units sold was higher than planned, leading to a favorable \$100,000 Flexible Budget/Selling Price Variance; but the quantity of units sold was lower than planned, leading to an unfavorable \$(480,000) Sales Volume Variance. Together, the two variances net to the Static Budget Variance of \$(380,000) Unfavorable.

The **Static Budget Variance** is also the actual results (\$2,500,000 for revenues) minus the Static Budget (\$2,880,000 for revenues).

**Exam Tip:** It is a good idea to be able to calculate these variances in all the different ways because an exam question could give information that requires one or the other method to be used.

For the direct materials variable cost line, the Sales Volume Variance is calculated on the variance report as **\$(196,800) – \$43,200 = \$(240,000) Favorable** and also as **\$1,200,000 – \$1,440,000 = \$(240,000) Favorable**. Since direct materials is a cost item, a negative variance is a favorable variance because it means the cost was less than budgeted.

We can also calculate the Sales Volume Variance for direct materials using the variance formula as follows:

$$(20,000 - 24,000) \times \$60 = \$ (240,000) \text{ F}$$

The \$60 used for "SP" in the formula can be calculated by dividing the budgeted cost for direct materials in either the Flexible or the Static Budget column by the budgeted number of units to be sold in the same column. The budgeted cost per unit will be the same whether it is calculated using the Flexible Budget column or the Static Budget column (\$1,200,000 ÷ 20,000 or \$2,440,000 ÷ 24,000).

Like the Flexible Budget Variances, the Sales Volume Variances can be calculated for every variable line on the Sales Variance Report using the above Quantity Variance formula, the same as was done for the direct materials line.

The Sales Volume Variance for the fixed costs line is zero because fixed costs do not vary with changes in the level of activity as long as the activity level remains within the relevant range. Therefore, the Static Budget amount for fixed costs and the Flexible Budget amount for fixed costs are the same.

For an analysis of the contribution margin line, the "SP" to use in the formula is the budgeted contribution margin per unit (that is, budgeted price per unit minus total budgeted variable cost per unit). In the example above, the average budgeted revenue per unit is \$120, the average total budgeted variable cost per unit is \$88 (\$1,760,000 ÷ 20,000 in the Flexible Budget or \$2,112,000 ÷ 24,000 in the Static Budget), and the budgeted contribution margin per unit is \$32 (\$120 – \$88).

The Sales Volume Variance for the contribution margin line is:

$$(20,000 - 24,000) \times \$32 = \$ (128,000) \text{ U}$$

On the Sales Variance Report, the Sales Volume Variance for the contribution margin line is calculated in two ways:

- 1) Static Budget Variance minus Flexible Budget Variance, or \$(168,200) – \$(40,200) = \$(128,000) U
- 2) Flexible Budget Amount minus Static Budget Amount, or \$640,000 – \$768,000 = \$(128,000) U



On the Contribution Margin line, a negative variance in the contribution margin line is Unfavorable because the Contribution Margin line is a net income line.

### The Sales Variance Report Cross Foots

Now that you know how the variance columns on the Sales Variance Report are calculated, you should be able to cross foot all the variances on the "Total Variable Costs," "Contribution Margin," and "Operating Income" lines of the Variance Report for a Single Product Company a few pages back by calculating them both down and across. Make sure to use the +/- key to input negative numbers on a calculator.

**Exam Tip:** If on an exam you are given a variance report that includes an operating income line and asked only what the Sales Volume Variance is without specifying a line, the question is probably asking for the "bottom line," or the Sales Volume Variance for operating income. There are two ways to calculate the Sales Volume Variance for operating income.

- 1) The first way is to calculate the Sales Volume Variance for the contribution margin, as we have done here. The Sales Volume Variance for the contribution margin will be the same as the Sales Volume Variance for operating income because the only difference between the contribution margin line and the operating income line is fixed costs, and there can be no Sales Volume Variance for fixed costs. On the Sales Variance Report above, the Sales Volume Variance for the Operating Income line is the same as the Sales Volume Variance for the Contribution Margin line.
- 2) The second way is to subtract the **Static Budget Operating Income** from the **Flexible Budget Operating Income**.

### Sales Variances When More than One Product is Sold

A company that sells more than one product (that is, a multiple-product firm) will have a Flexible Budget Variance similar to that of a single-product firm, but the Flexible Budget Variance is calculated differently for a multiple-product firm. Furthermore, this multiple-product firm's Sales Volume Variance is subdivided into a **Sales Mix Variance** and a **Sales Quantity Variance**.

The method for breaking down the Sales Volume Variance into the Sales Quantity Variance and the Sales Mix Variance for a multiple-product firm is similar to the method used to break down the Quantity Variance for manufacturing input costs when there is more than one input.

Do not get confused by the similar names for the sales volume and the sales quantity variances.

- A single-product firm will have **Flexible Budget Variances** and **Sales Volume Variances**.
- A multiple-product firm will also have **Flexible Budget Variances** and **Sales Volume Variances**, but each of its Sales Volume Variances will be subdivided into a **Sales Quantity Variance** and a **Sales Mix Variance**.

For a multiple-product firm, the sales quantity variance is one of two components of its sales volume variance for each line. The other component is the sales mix variance.

We are going to illustrate sales variances for a multiple-product firm using a Variance Report similar to the one we used to illustrate variances for a single-product firm. However, before we can calculate the variances for the multiple-product firm, the Flexible Budget needs to be changed slightly to include information about multiple products. To develop the Flexible Budget amounts for revenue and variable costs, we cannot simply take the Static Budget dollar amounts, divide them by the total number of units budgeted to be sold, and multiply by the number of units actually sold the way we did for the single product firm.

A multiple-product company will have a different sales price and a different variable cost **for each product sold**. Therefore, we need to develop Flexible Budget amounts for revenues, variable costs, and the contribution margin on the basis of each product's individual budgeted sales price and individual budgeted

variable costs and the effect that the variances in each one's sales volume have on those amounts as components of the total. The Flexible Budget amounts will be calculated individually for each product sold, using the actual quantity sold and the budgeted price and budgeted variable cost per unit. The individual amounts will then be summed to calculate the Flexible Budget amounts that will appear on the variance report and be used to calculate Flexible Budget Variances.

**Note:** If a Static Budget is not used for variance reporting and **only a Flexible Budget is used** to make the comparisons to actual results, there will be **no Sales Volume Variance** because the actual units sold will be equal to the budgeted units sold according to the Flexible Budget. This is a condition similar to that of a single-product firm. For the multiple-product firm, the Flexible Budget amounts are calculated for each product individually using the actual number of units sold of each product and the budgeted price or variable cost of each product, and then those amounts are summed to calculate the Flexible Budget amounts.

There can be a Sales Volume Variance only when the actual results are compared to the **Static** Budget for both the single-product firm and the multiple-product firm.

Here is our variance report with the revised Flexible Budget amounts. The amounts on the variance report that have changed are shaded. The details behind the amounts on the revenue line are given on the page following the variance report. The details behind all the lines are presented in Appendix B.

Variance Report for a Company Selling Two Products						
	<u>Col. 1</u>	<u>Col. 2</u> (2)=(1)-(3)	<u>Col. 3</u>	<u>Col. 4</u> (4)=(3)-(5)	<u>Col. 5</u>	<u>Col. 6</u> (6)=(1)-(5) also (6)=(2)+(4) Static Budget Variances
	<u>Actual Results</u>	<u>Flexible Budget Variances</u>	<u>Flexible Budget</u>	<u>Sales Volume variances</u>	<u>Static Budget</u>	<u>Static Budget Variances</u>
Units sold	20,000	0	20,000	4,000 - U	24,000	4,000 - U
Revenues	\$2,500,000	\$125,000+ F	\$2,375,000	\$505,000 - U	\$2,880,000	\$380,000 - U
Variable costs	<u>1,900,200</u>	<u>160,200+ U</u>	<u>1,740,000</u>	<u>372,000 - F</u>	<u>2,112,000</u>	<u>211,800 - F</u>
Contrib. margin	\$ 599,800	\$ 35,200 - U	\$ 635,000	\$133,000 - U	\$ 768,000	\$168,200 - U
Fixed costs	<u>570,000</u>	<u>18,000+ U</u>	<u>552,000</u>	<u>0</u>	<u>552,000</u>	<u>18,000+ U</u>
Oper. income	<u>\$ 29,800</u>	<u>\$ 53,200 - U</u>	<u>\$ 83,000</u>	<u>\$133,000 - U</u>	<u>\$ 216,000</u>	<u>\$186,200 - U</u>
		\$53,200 U		\$133,000 U		
		Total flexible budget variance		Total sales volume variance		
		\$186,200 U				
		Total static budget variance				

The total Static Budget Variance is still the same as the previous example: \$186,200 U. However, the **flexible budget amounts** for Revenues, Variable Costs, and the Contribution Margin have changed; therefore, the Flexible Budget Variances and Sales Volume Variances for those lines have also changed.

Below is a Detail Schedule for revenue, showing the calculations behind the revenue line on the above Variance Report for a company selling two products. On the Detail Schedule, the total number of units sold and total revenue amounts for the actual results, Static Budget, and Flexible Budget match the amounts on the above Variance Report. Also, on the Detail Schedule the average revenue per unit for the actual results (\$125) and the Static Budget (\$120) are equal to the budgeted and actual prices per unit that were calculated for the single-product firm when we divided revenue by the number of units sold. However, the Flexible Budget amount on the Detail Schedule is different from that of the single-product firm.

(Numbers on the revenue line of the previous variance report appear on this Detail Schedule in bold face.)

**Detail Schedule for revenue line on variance report for a company selling two products:**

	<b>Revenue Per Unit (Sales Price)</b>	<b># Units Sold</b>	<b>Total Revenue</b>	<b>Weighted Avg. Price Per Unit (Tot Rev/Tot Units)</b>
<b><u>Actual Results</u></b>				
Total Revenue:	<b>AP</b>	<b>AQ</b>		
Product A	\$122	12,500	\$ 1,525,000	
Product B	130	<u>7,500</u>	<u>975,000</u>	
		20,000	<b>\$2,500,000</b>	\$125.00
			(Rev. line, col. 1 on Variance Rpt.)	

**Flexible Budget (budgeted sales prices per unit, actual # sales)**

Total Revenue:	<b>SP</b>	<b>AQ</b>		
Product A	\$115	12,500	\$ 1,437,500	
Product B	125	<u>7,500</u>	<u>937,500</u>	
		20,000	<b>\$2,375,000</b>	<b>\$118.75</b>
			(Rev. line, col. 3 on Variance Rpt.)	<b>This is waspAM*</b>

**Static Budget**

Total Revenue:	<b>SP</b>	<b>SQ</b>		
Product A	\$115	12,000	\$ 1,380,000	
Product B	125	<u>12,000</u>	<u>1,500,000</u>	
		24,000	<b>\$2,880,000</b>	<b>\$120.00</b>
			(Rev. line, col. 5 on Variance Rpt.)	<b>This is waspSM*</b>

\* waspAM (weighted average standard price of the actual mix) and waspSM (weighted average standard price of the standard [budgeted] mix) will be discussed in detail later.

### Flexible Budget Variance for a Multiple-Product Firm

The Flexible Budget Variance (for the revenue line, also called the Selling or Sales Price Variance) measures the amount of the variance between the actual results and the static budget amount that was due to the actual selling prices (for the revenue line) or the actual costs (for the variable cost lines) for each product being different from their planned amounts.

The Selling Price Variance (the Flexible Budget Variance for revenue) for a multiple-product firm is determined **by calculating each product's individual selling price variance and summing them**, as follows. The amounts come from the Detail Schedule above.

The **Selling Price Variance** for the revenue line is:

$$\Sigma (AP - SP) \times AQ$$

Or

$$\text{For Product A: } (\$122 - \$115) \times 12,500 = \$ 87,500 \text{ F}$$

$$\text{For Product B: } (\$130 - \$125) \times 7,500 = \underline{37,500} \text{ F}$$

$$\text{Total Selling Price/Flexible Budget Variance} \quad \underline{\underline{\$125,000 \text{ F}}}$$

This favorable Selling Price Variance indicates that 1) we received more revenue per unit sold than we expected to (the selling price was higher), and 2) the Sales Volume Variance must be an unfavorable variance of \$(505,000). Remember that the Flexible Budget Variance plus the Sales Volume Variance equals the Static Budget Variance. The Static Budget Variance for revenue is \$(380,000). Therefore, the Sales Volume Variance must be \$(380,000) - \$125,000 = \$(505,000).

**Note:** Remember, the Selling Price Variance is also the Flexible Budget Variance for the revenue line. You can confirm the two variances are the same by looking at the Variance Report for the company selling two products, which shows the \$125,000 F in the Flexible Budget Variance column on the revenue line.

This Selling Price Variance/Flexible Budget Variance for revenue is unrelated to sales volume. It is strictly the portion of the total Static Budget Variance that occurred because the sales prices received for the units sold were different from the budgeted sales prices. Since the Static Budget Variance is \$(380,000) Unfavorable, we know that something else must have impacted the revenue line unfavorably to cause it to go from \$125,000 Favorable in the selling price variance to \$(380,000) Unfavorable for the static budget variance.

The Flexible Budget Variance can be calculated for every variable line on the variance report, not just for revenue. When we calculated the Flexible Budget Variance for revenue, it was also called the Selling Price Variance. If we calculated the same variance for direct labor, it would be called the Flexible Budget Variance, but it would be calculated in the same manner as the Selling Price Variance.

When we are calculating the Flexible Budget Variance for a multiple-product firm for the variable cost line using the Price Variance formula above, the "**AP**" and "**SP**" to use in the formula for each product are the actual cost and budgeted cost per unit. Those amounts come from the company's internal records. They are not available on the report itself. If we are calculating the Flexible Budget Variance for the contribution margin line, the "**AP**" and "**SP**" to use in the formula for each product are the actual contribution margin per unit (actual price per unit minus actual variable cost per unit) and the budgeted contribution margin per unit (budgeted price per unit minus budgeted variable cost per unit).

### Sales Volume Variances for a Multiple-Product Firm

The total **Sales Volume Variance** for a multiple-product firm is calculated using the Sales Volume Variance for each product individually and then summing the individual variances. This total Sales Volume Variance will in turn be broken down into two sub-variances: the **Sales Quantity Variance** and the **Sales Mix Variance**.

To calculate the total Sales Volume Variance for the revenue line of the example, use the actual number of units sold for each product (AQ), the number of units budgeted to be sold for each product (SQ), and the budgeted sales price for each product (SP). (These amounts are shown on the Detail Schedule for revenue above.) For Product A, the AQ is 12,500 units and the SQ is 12,000 units. For Product B, the AQ is 7,500 units and the SQ is 12,000 units. The budgeted sales prices from the Detail Schedule are \$115 for Product A and \$125 for Product B.

$$\Sigma (AQ - SQ) \times SP$$

or

$$\text{For Product A: } (12,500 - 12,000) \times \$115 = \$ 57,500 \text{ F}$$

$$\text{For Product B: } (7,500 - 12,000) \times \$125 = \underline{(562,500)} \text{ U}$$

**Sales Volume Variance**

**\$(505,000) U**

The Sales Volume Variance tells us that even though the sales prices were higher than budgeted, the sales of Product B (7,500 units) were significantly below the budgeted amount of 12,000 units. Sales of Product A were slightly above the budgeted amount of 12,000 units, but not enough to offset the unfavorable variance in Product B sales. The result was a Sales Volume Variance for the company of \$(505,000) Unfavorable.

The favorable Selling Price Variance (Flexible Budget Variance for the revenue line) of \$125,000 and the unfavorable Sales Volume Variance for the revenue line of \$(505,000) together net to the Static Budget Variance of \$(380,000) Unfavorable for the revenue line.

Like other sales variances, the Sales Volume Variance can be calculated for every variable line on the Variance Report, not just for revenue. If you are calculating the Sales Volume Variance for a variable cost line, the "**SP**" to use in the formula for each product is the budgeted variable cost per unit. If you are calculating it for the contribution margin line, the "**SP**" to use in the formula for each product is the budgeted contribution margin per unit (budgeted price minus budgeted variable cost).

For a multiple-product firm, the Sales Volume Variance is subdivided into the **Sales Quantity Variance** and the **Sales Mix Variance**. The Sales Quantity Variance represents the portion of the \$(505,000) Unfavorable Sales Volume Variance that occurred because, in total, the **number of units sold** was different from what was budgeted. The Sales Mix Variance represents the portion of the Sales Volume Variance that occurred because the **mix of products sold** was different from the budgeted mix.

**Note:** Do not get confused by similar terms related to single- and multiple-product firms. The Sales Quantity Variance for a multiple-product firm is a different variance from the Sales Volume (Quantity) Variance for a single-product firm.

Furthermore, although the Selling Price Variance is the Flexible Budget Variance for a single-product firm and a multiple-product firm, the variance is calculated differently for a multiple-product firm.

### Sales Quantity Variance for a Multiple-Product Firm (Sales Volume Sub-variance #1)

The Sales Quantity Variance measures the effect of the difference between the **actual total units sold of all products** and the **budgeted total units of all products expected to be sold**. The Sales Quantity Variance does not take into consideration variances due to differences in the mix of products sold.

To calculate the Sales Quantity Variance for a multiple-product firm, we use the Quantity Variance formula, but we use the **weighted average standard price for the standard mix (waspSM)** in the formula in place of the standard price. The waspSM is \$120 and is highlighted in the Static Budget portion of the Detail Schedule for revenue (above). The **AQ** and **SQ** used in the formula are also on the Detail Schedule, **AQ** being 20,000 units and **SQ** being 24,000 units.

The **Sales Quantity Variance** formula is:

$$(AQ - SQ) \times \text{waspSM}$$

The Sales Quantity Variance for the revenue line is:

$$(20,000 - 24,000) \times \$120 = \underline{\$ (480,000)} \text{ U}$$

This Sales Quantity Variance for revenue is the same amount as the Sales **Volume** Variance for revenue in the example of a single-product firm. However, this is not the same amount as the Sales **Volume** Variance in the example of a multiple-product firm. The Sales Volume Variance was calculated for the multiple-product firm above as \$(505,000) Unfavorable.

The Sales **Quantity** Variance for the multiple-product firm is the same as the Sales **Volume** Variance for the single-product firm because the Sales Quantity Variance is not affected by this company having more than one product. The Sales Quantity Variance analyzes only the effect of the differences between actual and budget in terms of **total units sold**, regardless of which products were sold.

The Sales Quantity Variance for revenue indicates that because this company planned to sell 24,000 units of both products and sold only 20,000 units of both products, its actual total revenue for all units sold was lower than the static budget by \$480,000, which was unfavorable. We can make that same statement about the single product firm.

Like the other variances on a Sales Variance Report, the Sales Quantity Variance can be calculated for every variable line on the variance report, not just for revenue. If you are determining Sales Quantity Variance for a variable cost line, calculate the weighted average standard variable cost for the standard mix to use as waspSM in the formula. If you are determining the Sales Quantity Variance for the contribution margin line, calculate the weighted average standard **contribution margin** for the standard mix to use as waspSM in the formula.

The Sales Mix Variance, which is covered next, incorporates the impact of the difference between the actual product mix sold and the budgeted product mix and its effect on the line being analyze, which in this case is revenue.

### Sales Mix Variance for a Multiple-Product Firm (Sales Volume Sub-variance #2)

If product sales for a multiple-product firm occur in different proportions than was planned for, and if the planned sales prices for the various products are different from one another, there will be a Sales Mix Variance for the Total Revenue line. The Sales Mix Variance measures the effect of the difference between the proportions of total units sold represented by each product as planned compared to what actually occurred.

Just as we did with the manufacturing mix variance, we will use waspAM (the weighted average standard price for the actual mix) and waspSM (the weighted average standard price for the standard mix) in calculating the Sales Mix Variance for the revenue line.

The weighted average standard price for the actual mix (waspAM), \$118.75, has already been calculated in the Detail Schedule for revenue (above, under the Flexible Budget heading). The weighted average standard price for the standard mix (waspSM), \$120.00, has also been calculated in the Detail Schedule (under the Static Budget heading).

The **Sales Mix Variance** formula is:

$$(\text{waspAM} - \text{waspSM}) \times \text{AQ}$$

The Sales Mix Variance for Revenue is:

$$(\$118.75 - \$120.00) \times 20,000 = \underline{\underline{\$(25,000) \text{ U}}}$$

Product A was planned to represent only 50% of sales, but it actually represented 62.5% of sales (that is, 12,500 units divided by the total sales of 20,000 units). The price for Product A (\$115) was planned to be lower than the price for Product B (\$125). Because the lower-priced product made up a higher percentage of total sales than expected, the variance in Total Revenue caused by this different actual mix was \$(25,000) Unfavorable.

The Sales Mix Variance and the Sales Quantity Variance together make up the Sales Volume Variance when more than one product is sold. The Sales Mix Variance for revenue here is \$(25,000) Unfavorable, and the Sales Quantity Variance is \$(480,000) Unfavorable. Together, they total to the Sales Volume Variance of \$(505,000) Unfavorable.

Of the \$(505,000) Unfavorable Sales Volume Variance for revenue, \$(25,000) Unfavorable was caused by the actual mix of sales differing from the budgeted mix of sales, while \$(480,000) Unfavorable was caused by sales in total of all units being lower than budgeted.

### Total Sales Variance for a Multiple-Product Firm

Here are the three variances that together make up the causes of the **static budget variance** in the revenue line, which in our variance report for a multiple-product firm is \$(380,000) Unfavorable.

Selling Price Variance	\$ 125,000 F	
Sales Quantity Variance	(480,000) U	} Sales Volume Variance \$(505,000)
Sales Mix Variance	<u>(25,000) U</u>	
Static Budget Variance	<u><u>\$(380,000) U</u></u>	

The Sales Quantity Variance plus the Sales Mix Variance are equal to the Sales Volume Variance for the revenue line on the variance report for the multiple-product firm. Furthermore, the Selling Price Variance is equal to the Flexible Budget Variance for the revenue line. The Flexible Budget Variance measures the causes for variances due to factors **other than** a variance in total units sold.

**Note:** Remember that all of these variances can be calculated for every variable line on a variance report in the same way as the revenue line is analyzed.

If you are analyzing a variable cost line, a **negative** variance is a **Favorable** variance and a **positive** variance is an **Unfavorable** variance. These interpretations are the opposite of the way negative and positive variances are interpreted for the revenue and the contribution margin lines.

The "Total Variable Costs," "Contribution Margin," and "Operating Income" lines on the variance report should cross foot, and they will do so if they are calculated correctly and if the plusses and minuses above them are correct and are input correctly into a calculator.

The detail for the variable cost line and the contribution margin line on a variance report for a company selling two products are not included here. However, the report and full detail schedules for the revenue, variable cost, and contribution margin lines appear in Appendix B.



## Variances Example Using Contribution Margin

The following example has no connection with the variance report and examples we have been using up to this point. The contribution margin line is analyzed in this example.

**Example:** New Company, a newly created firm, produces chairs and tables. The budgeted sales data for the first month of operation follows (CM stands for contribution margin per unit):

	<u>Budgeted CM</u>	<u>Actual CM</u>	<u>Budgeted Units</u>	<u>Actual Units</u>
Chairs	\$ 60	\$ 50	150	100
Tables	\$ 250	\$ 300	60	50

### 1) Calculation of the Static Budget Total Contribution Margin Variance

The actual contribution margin for both products is:

For chairs	$100 \times \$50 =$	\$ 5,000
For tables	$50 \times \$300 =$	<u>15,000</u>
<b>Total actual contribution margin</b>		<b>\$20,000</b>

The budgeted contribution margin for both products is:

For chairs	$150 \times \$60 =$	\$ 9,000
For tables	$60 \times \$250 =$	<u>15,000</u>
<b>Total budgeted contribution</b>		<b>\$24,000</b>

<b>Static Budget total contribution margin variance</b>	<b><u>\$ 4,000</u> U</b>
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The total variance is \$4,000 Unfavorable, meaning that the actual contribution margin was \$4,000 less than had been budgeted. To determine whether the problem was in the quantity or the contribution per unit, the next step is to break down this total contribution margin variance into the Flexible Budget Variance and the Sales Volume Variance.

### 2) Calculation of the Flexible Budget Variance for the Contribution Margin

The Flexible Budget Variance for the contribution margin is the sum of the Flexible Budget Variances for the contribution margins for each item. The Flexible Budget Variance for each item is calculated as  $(AP - SP) \times AQ$ , and so the total Flexible Budget Variance is  $\Sigma (AP - SP) \times AQ$ . (Remember that P is actually the contribution margin for this analysis.)

The total Flexible Budget Variance for the contribution margin is then found by summing the individual Flexible Budget Variances for the contribution margins of each product, as follows:

For chairs	$(\$50 - \$60) \times 100 =$	\$(1,000) U
For tables	$(\$300 - \$250) \times 50 =$	<u>2,500 F</u>
<b>Flexible Budget Variance</b>		<b><u>\$1,500 F</u></b>

This means that the company's contribution margin was \$1,500 greater than budgeted, which is a favorable variance. Although the contribution margin per unit for chairs was less than planned, the contribution margin per unit for tables was more than was planned, and the favorable variance for tables was greater than the unfavorable variance for chairs.

(Continued)



**3) Calculation of the Sales Volume Variance**

First, the Sales Volume Variance is calculated individually for each product and then these amounts are summed. The formula to use is  $\Sigma (AQ - SQ) \times SP$ . The Sales Volume Variance calculation for the contribution margin line is as follows:

For chairs	$(100 - 150) \times \$60$	= \$ (3,000) U
For tables	$(50 - 60) \times \$250$	= <u>(2,500) U</u>
<b>Sales Volume Variance</b>		<b><u>\$(5,500) U</u></b>

The company's contribution margin was \$5,500 less than budgeted due to differences between the actual number of units sold and the number of units budgeted to be sold.

This \$5,500 must be broken down to determine if the problem was in the mix of what was sold (the Sales Mix Variance), or if it was simply that not enough units were sold (the Sales Quantity Variance), or both.

**3a) Calculation of the Sales Quantity Variance**

The Sales Quantity Variance for a multiple-product firm is equal to  $(AQ - SQ) \times \text{waspSM}$ . In other words, the variance is the difference between the actual total quantity sold and the budgeted total quantity, multiplied by the weighted average standard CM per unit for the standard sales mix (waspSM).

First, calculate the weighted average standard contribution margin for the standard sales mix (waspSM):

Budgeted contribution margin for chairs	\$60	$\times 150$	= \$ 9,000
Budgeted contribution margin for tables	\$250	$\times \underline{60}$	= <u>15,000</u>
Totals		210	<u>\$24,000</u>

Given that a total sales volume of 210 items was budgeted, the weighted average standard contribution margin per unit for the standard mix (waspSM) is \$114.28 ( $\$24,000 \div 210$ ). This means that if we asked a manager at the **beginning** of the year to provide the budgeted contribution margin from the sale of one "average" unit, the answer would be \$114.28.

The total quantity actually sold and the total quantity budgeted are 150 and 210, respectively. Putting these items into the formula, we get:

$$(150 - 210) \times \$114.28 = \$ (6,856.80), \text{ or a } \mathbf{\$6,856.80 \text{ Unfavorable Sales Quantity Variance}}$$

The company's contribution margin was lower than budgeted by \$6,856.80 because it did not sell enough units.

**3b) Calculation of the Sales Mix Variance**

The formula for the Sales Mix Variance is  $(\text{waspAM} - \text{waspSM}) \times AQ$ , which represents the difference between the weighted average standard contribution margin for the **actual** mix and the weighted average standard contribution margin for the **standard** mix, multiplied by the total quantity of units actually sold.

We have already calculated the weighted average standard contribution margin for the standard mix (waspSM). The weighted average standard contribution margin for the actual mix (waspAM) is calculated as follows:

Contribution margin for actual chairs sold			
at the standard contribution margin per unit	\$60	$\times 100$	= \$ 6,000
Contribution margin for actual tables sold			
at the standard contribution margin per unit	\$250	$\times \underline{50}$	= <u>12,500</u>
Total contribution margin for actual sales			
at standard contribution margin per unit		150	\$18,500

(Continued)

Because 150 items were actually sold, the weighted average standard contribution margin per unit for the actual mix (waspAM) is \$123.33 ( $\$18,500 \div 150$ ). This means that if we asked a manager at the **end** of the year what the budgeted contribution was from one "average" unit actually sold, the answer would be \$123.33.

Putting these figures into the formula, we get:

$$(\$123.33 - \$114.28) \times 150 = \mathbf{\$1,357.50 \text{ Favorable Sales Mix Variance}}$$

Thus, because the company sold a mix that was actually more heavily weighted to the higher-contribution item (tables), it received \$1,357.50 more contribution margin than if the actual quantity sold had been sold in the planned mix.

Unfortunately for the company, the low quantity sold was more of a factor than the good mix sold, and so the company had an unfavorable total Sales Volume Variance of \$(5,500.00) Unfavorable.

#### 4) Reconciliation

The sum of the Sales Quantity Variance and the Sales Mix Variance should reconcile to the Sales Volume Variance, and they do:

Sales Quantity Variance	\$ (6,856.80)	Unfavorable
Sales Mix Variance	<u>1,357.50</u>	Favorable
<b>Net Variance</b>	<b>\$(5,499.30)</b>	<b>Unfavorable</b>

The Sales Volume Variance is \$(5,500). The \$0.70 difference is due to rounding and is of no concern.

#### Summary of Sales Variances

- The Static Budget Variances (actual results minus the Static Budget) are broken down between Flexible Budget Variances and Sales Volume Variances.
- The Flexible Budget Variance plus the Sales Volume Variance equals the Static Budget Variance.
- The Flexible Budget Variances are due to differences in price or cost per unit between the actual results and the budgeted amounts, while the Sales Volume Variances are due to differences between the actual quantity sold and the quantity budgeted to be sold in the static budget.
- When the actual results are compared to the flexible budget, there will be no Sales Volume Variance (that is, the Sales Volume Variance will be zero) because the "quantity sold" in the flexible budget is the same as the actual quantity sold.
- When the firm sells more than one product, its Sales Volume Variances are further broken down between Sales Quantity Variances and Sales Mix Variances.
- The Sales Quantity Variance measures the effect of the difference between the total units actually sold of all products and the total units budgeted to be sold of all products.
- The Sales Mix Variance measures the effect of the difference between the proportions of total units sold represented by each product as planned compared to what actually occurred.
- All variances can be calculated for every line on a Sales Variance Report.
- The "total variable costs," "contribution margin," and "operating income" lines on the Sales Variance report should cross foot.

Question 133: Actual and budgeted information about the sales of a product are presented for June as follows.

	<u>Actual</u>	<u>Budget</u>
Units	8,000	10,000
Sales Revenue	\$92,000	\$105,000

The sales price variance for June was:

- a) \$8,000 favorable.
- b) \$10,000 favorable.
- c) \$10,000 unfavorable.
- d) \$10,500 unfavorable.

(CIA Adapted)

Question 134: The following exhibit reflects a summary of performance for a single item of a retail store's inventory for April.

	<u>Actual Results</u>	<u>Flexible Budget Variances</u>		<u>Flexible Budget</u>	<u>Static (Master) Budget</u>
Sales (units)	<u>11,000</u>	<u>--</u>		<u>11,000</u>	<u>12,000</u>
Revenue (sales)	\$208,000	\$12,000 Unfavorable		\$220,000	\$240,000
Variable costs	<u>121,000</u>	<u>11,000</u> Unfavorable		<u>110,000</u>	<u>120,000</u>
Contribution margin	\$ 87,000	\$23,000 Unfavorable		\$110,000	\$120,000
Fixed costs	<u>72,000</u>	<u>--</u>		<u>72,000</u>	<u>72,000</u>
Operating income	<u>\$ 15,000</u>	<u>\$23,000</u> Unfavorable		<u>\$ 38,000</u>	<u>\$ 48,000</u>

The sales volume variance is:

- a) \$1,000 favorable.
- b) \$10,000 unfavorable.
- c) \$11,000 favorable.
- d) \$12,000 unfavorable.

(CIA Adapted)

**The following information is for the next two questions:** Clear Plus, Inc. manufactures and sells boxes of pocket protectors. The static budget and the actual results for May are:

	<u>Actual</u>	<u>Static Budget</u>
Unit Sales	12,000	10,000
Sales	\$132,000	\$100,000
Variable cost of sales	<u>70,800</u>	<u>60,000</u>
Contribution Margin	61,200	40,000
Fixed Costs	<u>32,000</u>	<u>30,000</u>
Operating Income	<u>\$ 29,200</u>	<u>\$ 10,000</u>

Question 135: The flexible budget operating income for Clear, using a flexible budget for May is:

- a) \$12,000
- b) \$19,200
- c) \$30,000
- d) \$18,000

Question 136: Which one of the following statements concerning Clear's actual results for May is correct?

- a) The flexible budget variance is \$8,000 favorable.
- b) The sales price variance is \$32,000 favorable.
- c) The sales volume variance is \$8,000 favorable.
- d) The flexible budget variable cost variance is \$10,800 unfavorable.

(CMA Adapted)

Question 137: The following data is available for July. What is the sales quantity variance for the contribution margin for July?

	<u>Budget</u>	<u>Actual</u>
Sales	40,000 units	42,000 units
Selling price	\$6.00 per unit	\$5.70 per unit
Variable cost	\$3.50 per unit	\$3.40 per unit

- a) \$5,000 favorable.
- b) \$4,600 favorable.
- c) \$12,000 unfavorable.
- d) \$12,600 unfavorable.

(CIA Adapted)

## Market Variances

The Sales Quantity Variance is one of the two components of the Sales Volume Variance for a multiple-product firm. The Sales Quantity Variance measures the effect of the difference between the total units actually sold of all products and the total units budgeted to be sold of all products.

Like the Sales Volume Variance, the Sales Quantity Variance can also be broken down to discover the cause or causes of the variance in the total quantity sold. The total level of sales may be different from expected because (a) the market was bigger or smaller than expected or (b) because the company's share of the market was bigger or smaller than expected, or both.

The **Market Size Variance** is the variance in the contribution margin caused by the actual market size (in number of units) being different from the expected market size (in number of units). It is calculated as follows:

$$\left( \begin{array}{l} \text{(Actual Market Size in Units} \\ - \text{Expected Market Size in Units)} \\ \times \text{Expected Market Share \%} \end{array} \right) \times \begin{array}{l} \text{Weighted Average Standard} \\ \text{Contribution Margin per Unit} \\ \text{for the Standard Mix (waspsm)} \end{array}$$

The **Market Share Variance** is the variance in the contribution margin caused by the company's actual market share being different from its expected market share. It is calculated as follows:

$$\left( \begin{array}{l} \text{(Actual Market Share} \\ - \text{Expected Market Share)} \\ \times \text{Actual Market Size in Units} \end{array} \right) \times \begin{array}{l} \text{Weighted Average Standard} \\ \text{Contribution Margin per Unit} \\ \text{for the Standard Mix (waspsm)} \end{array}$$

For a single-product firm, the Sales Volume Variance (instead of the Sales Quantity Variance) is broken down between the Market Size Variance and the Market Share Variance using the two formulas above, with one exception. The standard contribution margin per unit used does not need to be a weighted average.

We will use the New Company example to illustrate calculation of market variances.

**Example:** New Company, a newly created firm, produces chairs and tables. The budgeted sales data for the first month of operation follows (CM stands for contribution margin per unit):

	<u>Budgeted CM</u>	<u>Actual CM</u>	<u>Budgeted Units</u>	<u>Actual Units</u>
Chairs	\$ 60	\$ 50	150	100
Tables	\$250	\$300	60	50

Market size information for New Company's first month of operation was:

	<u>Units Sold</u>	<u>Market Size In Units</u>
Actual	150	2,000
Expected	210	2,500

### 1) Calculation of the Sales Volume Variance

The following calculation of the Sales Volume Variance is repeated from the previous example for New Company.

(Continued)

First, the Sales Volume Variance is calculated individually for each product and then these amounts are summed. The formula to use is  $\Sigma (AQ - SQ) \times SP$ . The Sales Volume Variance calculation for the contribution margin line is as follows:

For chairs	$(100 - 150) \times \$60$	= \$ (3,000) U
For tables	$(50 - 60) \times \$250$	= <u>(2,500) U</u>
<b>Sales Volume Variance</b>		<b><u>\$(5,500) U</u></b>

The company's contribution margin was \$5,500 less than budgeted due to differences between the actual number of units sold and the number of units budgeted to be sold.

## 2) Calculation of the Sales Quantity Variance

The following calculation of the Sales Quantity Variance is also repeated from the previous example for New Company.

The Sales Quantity Variance for a multiple-product firm is equal to  $(AQ - SQ) \times \text{waspSM}$ . In other words, the variance is the difference between the actual total quantity sold and the budgeted total quantity, multiplied by the weighted average standard CM per unit for the standard sales mix (waspSM).

First, calculate the weighted average standard contribution margin for the standard sales mix (waspSM):

Budgeted contribution margin for chairs	\$60	$\times 150$	= \$ 9,000
Budgeted contribution margin for tables	\$250	$\times 60$	= <u>15,000</u>
Totals		210	<u>\$24,000</u>

Given that a total sales volume of 210 items was budgeted, the weighted average standard contribution margin per unit for the standard mix (waspSM) is \$114.28 ( $\$24,000 \div 210$ ).

The total quantity actually sold and the total quantity budgeted are 150 and 210, respectively. Putting these items into the formula, we get:

$$(150 - 210) \times \$114.28 = \$ (6,856.80), \text{ or a } \mathbf{\$6,856.80 \text{ Unfavorable Sales Quantity Variance}}$$

The company's contribution margin was lower than budgeted by \$6,856.80 because it did not sell enough units.

This \$6,856.80 unfavorable Sales Quantity Variance is now broken down between the amount of the variance due to the market size being different from the plan and the amount of the variance due to New Company's share of the market being different from the plan.

## 3a) Calculation of the Market Size Variance

The formula for the Market Size Variance is as follows:

$$\left( \begin{array}{l} \text{(Actual Market Size in Units)} \\ - \text{Expected Market size in Units)} \\ \times \text{Expected Market Share \%} \end{array} \right) \times \begin{array}{l} \text{Weighted Average Standard} \\ \text{Contribution Margin per Unit} \\ \text{for the Standard Mix (waspSM)} \end{array}$$

First, calculate New Company's expected market share:

New Company's expected market share is its expected sales in units for the period (210) divided by the expected market size in units (2,500), or .084 or 8.4%.

(Continued)

Calculate the weighted average standard contribution margin per unit for the standard mix (waspSM):

The waspSM was calculated previously and is shown here again.

Budgeted contribution margin for chairs	\$60	×	150	=	\$ 9,000
Budgeted contribution margin for tables	\$250	×	<u>60</u>	=	<u>15,000</u>
Totals			210		<u>\$24,000</u>

Given that a total sales volume of 210 items was budgeted, the weighted average standard contribution margin per unit for the standard mix (waspSM) is \$114.28 (\$24,000 ÷ 210).

Next, calculate the Market Size Variance by putting the numbers into the formula:

$$\text{Market Size Variance} = [(2,000 - 2,500) \times .084] \times \$114.28 = \underline{\underline{\$(4,799.76)}}.$$

The portion of the Sales Quantity Variance attributable to a smaller market size than anticipated is \$(4,799.76). The contribution margin was decreased by that amount because the actual market size was 500 units lower than expected.

### 3b) Calculation of the Market Share Variance

The formula for the Market Share Variance is:

$$\left( \begin{array}{l} \text{(Actual Market Share} \\ - \text{Expected Market Share)} \\ \times \text{Actual Market Size in Units} \end{array} \right) \times \begin{array}{l} \text{Weighted Average Standard} \\ \text{Contribution Margin per unit} \\ \text{for the Standard Mix (waspSM)} \end{array}$$

First, calculate New Company's Actual Market Share:

New Company's actual market share is its actual total sales in units for the period (150) divided by the actual market size in units (2,000), or .075 or 7.5%.

The expected market share was calculated above as 8.4%, the actual market size is given as 2,000 units, and the weighted average standard contribution margin per unit for the Standard Mix (waspSM) was calculated above as \$114.28.

Finally, calculate the Market Share Variance by putting the numbers into the formula:

$$\text{Market Share Variance} = [(.075 - .084) \times 2,000] \times \$114.28 = \underline{\underline{\$(2,057.04)}}.$$

The portion of the Sales Quantity Variance attributable to a smaller market share than anticipated is \$(2,057.04). The contribution margin was decreased by that amount because New Company's actual market share was lower than expected: 7.5% instead of the expected 8.4%.

### Reconciliation

The total of the Market Size Variance and the Market Share Variance should reconcile to the Sales Quantity Variance, and they do:

Market Size Variance	\$ (4,799.76)
Market Share Variance	<u>(2,057.04)</u>
<b>Sales Quantity Variance</b>	<b><u>\$ (6,856.80)</u></b>

**Exam Tip:** On the Exam, you only need to know that these formulas exist and what they are. It is unlikely that you will need to apply or calculate with these formulas.

## **Variance Analysis for a Service Company**

A service company's "product" is the service it provides. An example of a pure service company is a public accounting firm. The public accounting firm has no cost of goods sold because its sole product is the service it provides. Some other service companies may offer a mixture of sales and service, for example one that sells repair parts for appliances and also installs them.

Service companies can have price variances, volume (quantity) variances, mix variances related to the services they provide, and overhead variances. If a service company provides service only, then it can calculate price, quantity, and mix variances for the revenue line. If the company provides services and products (such as replacement parts), the company should segregate its service revenue from its parts revenue in its accounting system. It can then limit its analysis of its service segment to just the revenue line while analyzing the parts sales variances the same way a reseller would analyze its sales variances: revenue, variable costs, and contribution margin.

Any company can perform variance analysis on its selling, general, and administrative overhead costs, as well. Variable overhead can be a large component of a service company's costs, and it needs to be used in making pricing and service mix decisions.

A service organization may have very high fixed overhead costs. If revenue declines, the fixed overhead costs remain and the company can very quickly find itself in financial trouble. Fixed overhead variance reporting can detect this impending trouble early and may enable the company to make changes in its fixed cost structure to respond to its decreased sales.

Furthermore, a company that manufactures a product or resells a product or products will have both fixed and variable overhead costs for its non-manufacturing functions within the company (such as distribution costs). Variance analysis provides a way of including these costs in pricing and product mix decisions.



## Responsibility Centers and Reporting Segments

A responsibility center is any part, segment, or subunit of an organization. A segment may be a product line, a geographical area, or any other meaningful unit. Companies will have different segments based on their activities. **Responsibility accounting** is an accounting system that measures accounting results of each responsibility center separately. It is also used to measure the consolidated results of the company as a whole.

A responsibility center's plans are expressed in its budget, and the actual results for that responsibility center are then compared against its budget to determine how well it is achieving its plans.

The budget is developed by the responsibility center and approved by top management. All of the responsibility centers combined make up the consolidated budget. For instance, a Sales Budget is developed for each individual responsibility center and all the responsibility centers' budgets together make up the consolidated Sales Budget. Consolidating all the different budgets for all the different responsibility centers is part of the process of developing the Master Budget.

The main purposes for responsibility centers and responsibility accounting are the evaluation of subunits' performance and to contribute to measuring the performance of the subunits' managers. Manager performance measurement provides motivation for managers of the subunits, which in turn benefits the company as a whole. The manager of a responsibility center should have the ability to control, or at least significantly influence, the results of the center over which he or she has control. For example, a person responsible for training in a company should not be granted or denied a bonus based on the world price of oil because the training manager has no control over the world price of oil.

The main classifications of centers, listed in order of the most fundamental (or basic) to the most complex, are:

- 1) A **Cost Center** is **responsible only for the incurrence of costs**. A cost center does not earn any revenue and therefore generates no profit. An equipment maintenance department or an internal accounting department is example of a cost center.

A cost center is the **least complex type of center** since it has no revenue or profit. Managers of cost centers are best evaluated by variance analysis of their incurred costs. The key standard for evaluating a cost center is its **efficiency of operations**, which measures whether or not the center has provided the required services within the budget.

**Note:** A **service department** or **service center** within a larger company is usually a cost center because it provides services to other departments, so it does not earn any revenue.

- 2) A **Revenue Center** is the opposite of a cost center in that it is responsible only for revenues. For example, a sales department is a revenue center. Though every department will incur some costs, the costs incurred by a revenue center are generally immaterial and may not even be controllable by the center. For example, a revenue center's costs may simply be allocated to them by the central company. Managers in revenue centers are evaluated according to the level of revenue that the center generates. **Effectiveness** is the key for their evaluation.
- 3) A **Profit Center** is a department responsible for both revenues and expenses. A department within a store, such as the hardware department, is an example of a profit center because it has both revenues and cost of goods sold. Because a profit center is responsible for both costs and revenues, the manager of a profit center should be evaluated on both costs and revenues generated by the profit center. In a profit center, **both efficiency and effectiveness are assessed**, but priority is given to effectiveness. In fact, the profit can be treated as the goal to be achieved.
- 4) An **Investment Center** is responsible for profit (revenues and costs) and for providing a return on the capital that has been invested into it by the larger organization to which it belongs. Because it is responsible for a return-on-investment, this type of department is the most like a regular and complete business by itself. However, it is still part of a larger organization. An example of an investment center is a branch office. **Effectiveness** in achieving and exceeding predetermined criteria is the key evaluation for an investment center manager.

In an investment center, the most important criterion for evaluation is the **return-on-investment** provided by the investment center.

**Note:** Given the nature of the measurement of an investment center (return-on-investment), it is preferable for a company to have **as many investment centers as possible** because the goal of any business (and therefore any part of a business) should be return on invested capital.

Any responsibility center is effectively a **unit for performance evaluation**. That performance evaluation may be for the unit itself, or it may be a part of the performance evaluation of the unit's manager, or it may be both. Responsibility centers exist to evaluate the performance of the various segments of the business and the performance of the their respective managers. Management uses this information to make strategic decisions such as, "Should we expand that location?" or "Should we promote that manager?"

The choice of evaluating a given responsibility center as a cost center, a revenue center, a profit center, or an investment center is a critical one. Although a designation may seem fairly clear-cut, in reality the choice is not always a simple one. For example, nearly any responsibility center can be evaluated as an investment center because every responsibility center uses fixed company assets. Even if those fixed assets are not used to generate revenue, the fixed assets can still provide a return on investment if, for example, they enable the company to do the same work at a lower cost.

The comparison of actual results against budgeted amounts by a responsibility center is important feedback. It lets the manager of the responsibility center and top management know how well a manager has followed his or her plan. To generate this feedback, the manager examines past performance in order to make better-informed decisions in the future. Thus, **feedback and the reporting of actual results, as compared to a plan, are the main links between planning and control**. It is important for feedback to be available in a timely manner, both to the manager and to top management. If it is not timely, it loses its relevance. Therefore, budget reports should be available as rapidly as possible after the end of a reporting period.

When used properly, budgets established within the framework of a responsibility accounting system provide systematic feedback for managers. Reports of variances from the budget (that is, differences between actual results and planned activity) should be used to direct attention to problems, and the emphasis should be on evaluating information rather than assigning blame. If variance reports are used properly, they can be helpful in evaluating a manager's performance. However, variance reports should not be the sole basis upon which managers are evaluated.

**Note:** Feedback is the main link between planning and control.

## Evaluating the Manager vs. Evaluating the Business Unit

A company must always make a distinction between the performance of a **manager** and the performance of the **business unit** that the manager manages. A company might assign one of its best managers to a unit that has been unprofitable in an effort to turn the unit around. The manager might take some time to effect a change, and in fact that unit might never be completely successful. The value of the manager's performance should not be judged only on the basis of the unit's performance.

When evaluating managers, a company should focus its attention **only on those factors that the manager can actually control**. If a manager is evaluated based on something that he or she is unable to control (either a cost or revenue), there is a risk that the manager may be blamed for or given credit for something for which he or she was not responsible. In other words, the performance evaluation of the manager should be the performance evaluation of **only** the manager. For example, information on the unit's performance should be **part of** the performance appraisal of the manager, but it should not be the **only** information considered in evaluating the manager.

**Note:** Because of the nature of the calculation of contribution (selling price minus variable costs), contribution margin is something that is under the control of the manager of a profit center only if that manager has the authority to set prices and make purchasing and other decisions. If managers cannot set the price and/or do not control purchasing decisions, they do not control the contribution margin.

If a responsibility accounting system with variance reporting is used as an evaluation tool, it should be structured so that costs that are not under the manager's control will be excluded or at least segregated from the controllable costs.

In a larger sense, responsibility accounting should actually focus on **information** and **knowledge** more than on control. A responsibility accounting system should be able to identify the person who can provide the most information about an item in question, whether or not that person has any control over the item.

**Example:** A manager of a fast food restaurant may be held responsible for reporting on variances in the profits of the unit, even though he or she does not have control over either the cost of the food or the price it is sold for. Decisions outside of the manager's control should not be part of the manager's performance evaluation. Even so, the manager can and should still be held responsible for reporting on the results because he or she is in the best position to explain the variances between actual and budgeted items.

## Allocation of Common Costs

**Common costs** are costs of operating a business that cannot be allocated to any specific user or users on any cause-and-effect basis. Examples of common costs are the chief executive officer's salary, the costs of the financial reporting function of the accounting department, and the costs of the budget department. These examples are all functions that serve at the administrative level in the organization, and their service cannot be traced to specific products or departments in any meaningful way. If any one segment of the business were to be discontinued, the common costs would continue. For example, the CEO is concerned with the performance of the whole organization, the CEO does not concentrate on any one department or product at a time, and if one segment of the business is discontinued, the cost of the CEO's salary would remain. Thus the CEO's salary cannot be effectively traced to individual departments or products.

Common costs are different from shared services costs. **Shared services** are also administrative services, but shared services are used by internal departments and usage of the service by the individual departments or products can be allocated to user departments in a meaningful way based upon a cost driver that represents their usage of the service. For example, costs of shared service departments such as IT, maintenance, legal, and accounting services such as invoicing, payroll and accounts payable can be allocated to users of the services on the basis of their usage. Allocation of shared services costs will be discussed later, in Section D, *Shared Services Cost Allocation*.

The following discussion pertains to common costs that cannot be allocated on the basis of usage. And yet, the common costs do need to be allocated, internally at least, primarily to provide accurate product costs for use in making decisions. The earnings from the operating units need to be adequate to cover the common costs.

However, when a responsibility reporting system is used for managers' performance evaluations, the system should separate costs that are controllable by the responsibility center managers from costs that are not controllable by them. Managers should not be held accountable in their performance reviews for costs over which they have no control. Ordinarily, common costs are not controllable by the managers of the segments that receive the allocated costs.

A company must make certain that all of the common costs are allocated to the operating departments, regardless of the method it uses to allocate common costs. If all of the common costs are not allocated to the production departments, the company runs the risk of not covering all of its costs as a whole because it does not have the necessary information, even though each department may be covering its own individual costs.

However, a company must consider the costs against the benefits when performing cost allocations. Costs of the allocation include the research necessary to do the cost allocations and the time required to educate the managers about cost allocations. The more complex the cost allocations are, the higher the costs to educate will be.

### Common Cost Allocation and Manager Evaluation

As we said above, consideration of common cost allocation should play no role in the evaluation process of managers. It is essential to evaluate a manager only on things that he or she can control. If the manager cannot control the amount of common costs allocated to his or her department, then allocated common costs should not be included in the evaluation of the manager.

### Stand-Alone Allocation vs. Incremental Allocation

Once the company has the costs to allocate and the departments designated to receive allocation, mathematical allocation needs to be done. Common costs can be allocated in two ways: as **stand-alone costs** or as **incremental costs**.

- 1) The **stand-alone cost allocation method** determines the weights for cost allocation by considering each user of the cost as a **separate entity**. When the stand-alone method is used, total common costs are distributed among the operating units based on each unit's proportion of the entire organization, using an appropriate basis. The basis used could be each responsibility center's other costs as a proportion of the company's total costs, or it could be the proportion of each responsibility center's sales in relation to total sales of the entire company, or anything else. Advocates of the stand-alone method maintain that it is fairer than the incremental cost-allocation method because each responsibility center bears a proportionate share of total costs.
- 2) The **incremental cost-allocation method** ranks units according to their size or on some similar basis. The largest unit is called the **primary** party. The primary party is charged for costs up to what its cost would be if it were the only unit. The remaining cost is allocated to the other unit or units, called **incremental** parties. The effect of the incremental method is that the largest unit bears all the fixed common costs plus an allocation of the variable common costs, whereas the incremental parties bear only an allocation of the variable common costs.

The primary advantage of the incremental method can be demonstrated in the example of a newly-formed sales office. The office's chances for survival may be greater if it is considered an incremental party so that it will bear a relatively low allocation of common costs.

On the other hand, if there is no credible basis for designating one unit as the primary party and others as incremental parties, the incremental method is not justified and can cause resentment on the part of the primary party. Of course, all the parties in an incremental cost allocation system will want to be designated incremental parties instead of the primary party.

### An Alternative to Cost Allocation

An alternative to cost allocation is to assign some percentage of each department's contribution to coverage of common costs, rather than allocating common costs to each department. This procedure can help managers of all the operating departments to see themselves as contributing to the overall success of the company rather than paying expenses for a central administration that they do not perceive as adding value to their operations.

The company needs to make certain that all common costs are covered, because if the individual departments do not meet their necessary targets the company risks failing to collect enough funds from its operations to pay for its common costs.

**Note:** Assigning some percentage of each operating department's contribution to covering common costs reminds each department that it is a part of a larger organization, and as such it has a responsibility to the larger organization to maintain earnings that are adequate to cover a portion of the firm's indirect costs; and it formalizes their accountability for doing so.

Question 138: If a company allocates common costs by weighting the costs of each user as a separate entity, it is using which one of the following cost allocation methods?

- a) Incremental
- b) Reciprocal
- c) Stand-alone
- d) Step-down

(ICMA 2013-2)

Question 139: The receipt of raw materials used in the manufacture of products and the shipping of finished goods to customers are under the control of the warehouse supervisor. Approximately 60% of the warehouse supervisor's time is spent on receiving activities and 40% on shipping activities. Separate employees handle the receiving and shipping operations. The labor-related costs for the warehousing function are as follows:

Warehouse supervisor's salary	\$ 40,000
Receiving clerks' wages	75,000
Shipping clerks' wages	55,000
Employee benefit costs (30% of wage and salary costs)	<u>51,000</u>
	<u>\$221,000</u>

The company employs a responsibility accounting system for performance reporting purposes. The costs are classified on the report as period or product costs. The total labor-related costs to list on the responsibility accounting performance report as product costs under the control of the warehouse supervisor for the warehousing function are:

- a) \$97,500
- b) \$128,700
- c) \$130,000
- d) \$169,000

(CIA Adapted)

Question 140: In a responsibility accounting system, managers are accountable for:

- a) Incremental costs.
- b) Product costs but not for period costs.
- c) Costs over which they have control.
- d) Variable costs but not for fixed costs.

(CIA Adapted)

## The Contribution Income Statement Approach to Evaluation

A contribution income statement differs from a traditional income statement. A traditional income statement uses absorption costing, and cost of goods sold includes both fixed and variable costs of production that were allocated to the units that were sold during the period. On a **contribution income statement**, fixed costs are segregated from variable costs and presented on separate lines. Only variable costs are allocated to production and thus to the units sold. Variable expenses include not only variable production costs but also variable selling, general, and administrative expenses. The contribution margin is the difference between revenues and **all** variable expenses (both production and non-production variable expenses). All fixed expenses, both production and non-production, are reported below the contribution margin line as a reduction to the contribution margin. The differences between the two types of income statements are explained in greater detail in Section D of this textbook, in *Variable and Absorption Costing*.

A variation of the contribution income statement can be used to isolate controllable costs of a business unit from its non-controllable costs, such as depreciation or allocated central costs. Thus, it is a way of evaluating managers of profit and investment centers. The contribution income statement used for evaluation has four "levels." Each level enables the evaluation of a different aspect of performance.

- The **segment manager's** performance is evaluated on the basis of revenues generated minus variable costs and fixed costs that are controllable by the segment manager.
- The **segment's** performance is evaluated on the basis of revenues generated minus variable costs, fixed costs that are controllable, and fixed costs that are not controllable by the segment manager but are traceable to the segment. A **traceable** fixed cost is a fixed cost that can be assigned to a particular segment on a cause-and-effect basis. A traceable fixed cost is a cost that would be eliminated if the segment were to be sold or closed.
- The last line on the statement includes fixed common costs that are not controllable by the segment manager and are not traceable to any specific segment. An untraceable cost is a cost that cannot be assigned to any particular segment on a cause-and-effect basis. If a particular segment were sold or closed, the untraceable cost would continue. Untraceable costs are common costs, and they are not controllable by the segment manager. These non-controllable, untraceable common costs are not included in the evaluation of either the segment manager or the segment.

The various lines on the report are explained in more detail following the example below.

**Example:** Here is a contribution income statement prepared for the company as a whole and then broken down by division:

	<b>Company as a whole</b>	<b>Division 1</b>	<b>Division 2</b>
Net Revenues	\$10,000	\$3,000	\$7,000
Variable Manufacturing Costs	<u>3,900</u>	<u>900</u>	<u>3,000</u>
<b>Manufacturing Contribution Margin (Level 1)</b>	6,100	2,100	4,000
Variable Nonmanufacturing Costs (selling, admin.)	<u>600</u>	<u>100</u>	<u>500</u>
<b>Contribution Margin (Level 2)</b>	5,500	2,000	3,500
Controllable Fixed Costs	<u>1,250</u>	<u>500</u>	<u>750</u>
<b>Controllable Margin or Short-term Segment Manager Performance (Level 3)</b>	4,250	1,500	2,750
Non-controllable, Traceable Fixed Costs	<u>2,000</u>	<u>600</u>	<u>1,400</u>
<b>Contribution by Strategic Business Unit or Segment Performance (Segment Margin) (Level 4)</b>	2,250	<b><u>\$ 900</u></b>	<b><u>\$1,350</u></b>
Non-controllable, Untraceable, Common Costs	<u>1,000</u>		
<b>Operating Income</b>	<b><u>\$1,250</u></b>		



**Level 1: Manufacturing Contribution Margin (Net Revenue Less Variable Manufacturing Costs)**

**Net revenues** represent the sales value of all sales for the period.

**Variable manufacturing costs** include all of the variable costs of production (such as labor, materials and variable overheads) that were incurred in the production of the **units sold**.

The manufacturing contribution margin of the company is the amount of money that is available to cover nonmanufacturing variable costs, all fixed costs, and then flow to profit. After all variable manufacturing costs have been covered, increases to the contribution margin flow directly to profit.

**Level 2: Contribution Margin (Manufacturing Contribution Less Variable Nonmanufacturing Costs)**

**Variable nonmanufacturing costs** include all variable costs that are not part of the production process. These include, but are not limited to, marketing, selling, and general and administrative costs that are variable in nature.

The contribution margin of the company is the amount of money that is available to cover fixed costs and then flow to profit after all variable costs are covered.

**Level 3: Controllable Margin (Contribution Margin Less Controllable Fixed Costs)**

**Controllable fixed costs** are fixed costs that the segment manager is able to control and influence. Examples of controllable fixed costs include salaries of supervisors who report to the segment manager and expenses incurred by the segment that only benefit that segment (such as sales promotions).

The controllable margin (also called **short-term segment manager performance**) is important because it is a measurement of all the revenues and expenses (variable and fixed) that are controllable by the individual managers on a short-term (that is, less than one year) basis. The controllable margin is a useful measure of a manager's short-term performance.

**Level 4: Segment Margin (Controllable Margin Less Non-controllable, Traceable Fixed Costs)**

**Non-controllable, traceable fixed costs** are fixed costs that cannot be controlled by the manager within a time span of one year or less. "Traceable" fixed costs are costs that would be eliminated if the segment were to be sold or closed. However, the decision to incur the costs may not be controllable by the segment manager. Non-controllable, traceable fixed costs are usually facilities costs such as depreciation, taxes, and insurance. They are included in the calculation of the segment margin but they are not included in calculating the controllable margin.

The segment margin (also called **contribution by strategic business unit**, or **contribution by SBU**) is a measure of the performance of each business unit. It may also be used as a measure of the **long-term** performance of the manager, **if** the manager can control the non-controllable traceable fixed costs over a long-term period. However, in many cases, decisions that affect non-controllable traceable fixed costs are made by others.

**Non-controllable, untraceable common costs** allocated to a segment must not be used in evaluating the performance of the segment or the segment manager. Non-controllable, untraceable fixed costs are costs that are incurred at the company level and would continue even if the individual segment were discontinued. The company needs to be able to cover these important costs. However, these costs should not be a part of a segment manager's performance evaluation, because the segment manager has no control over them. For purposes of evaluation, they can be omitted from the individual segment reports. Omitting them from the individual segment reports will prevent the sum of the individual segments' net incomes from reconciling to the company's consolidated net income. To illustrate, in the above example the sum of the two divisions' contributions is \$2,250 (\$900 + \$1,350), but the company's consolidated net income is only \$1,250. The difference is \$1,000 in untraceable, common costs that have not been allocated to either division but that have reduced the consolidated net income.

### Use of the Contribution Income Statement

A contribution income statement (such as the example above) is very flexible. It can be used to measure a manager's performance. It can also be used to measure the performance of a profit or investment center to determine whether the segment should be dropped, retained, or expanded. The contribution income statement analysis can be extended to the product level, with each segment's total revenues and expenses assigned to the various products produced by that division. This type of product profitability analysis can be used to determine which products are contributing to the overall untraceable costs and which are not.

In the above performance report, the **segment margin** for each division is equal to the segment's total sales minus all variable and fixed costs of the segment that are traceable to the segment, whether controllable by the segment manager or not.

The only costs that are not included as expenses in the calculation of each division's segment margin are the non-controllable, untraceable common costs on the very last expense line. An example of untraceable, common costs is the chief executive officer's compensation. The CEO's time is spent managing all the divisions of the company, but his or her compensation cannot be allocated according to the amount of time spent on each division. The majority of the CEO's time is spent managing the entire company, not just one division at a time. Another example would be a company's sponsorship of a sporting event such as the World Cup or the Olympics. It is very difficult to determine how much any individual department or segment benefits from such a sponsorship. Furthermore, the sponsorship decision would have been made at the top levels of management without input from responsibility center managers. Therefore, this type of marketing expense is not allocated to the individual responsibility centers on a contribution income statement that will be used for performance evaluation.

The untraceable, common costs from the above example may actually have been allocated between the two segments within the company's accounting system on some reasonable basis. But for the purposes of segment performance evaluation, any allocations of the non-controllable, untraceable common costs made in the accounting system must be pulled out of the individual segments' performance reports and shown only as costs of the company as a whole.

**Exam Tip:** You need to know how to calculate all of these different margins that are included in the above contribution statement.

### Profit Margin Ratio

A profit margin ratio is a measure of the amount of sales that actually become profits. It is the net income (or profit) amount divided by revenue (or sales).

In order to increase the profit margin a manager must either:

- **Increase sales** while holding costs constant, or
- **Decrease costs** without losing sales, or
- **Increase sales at a rate greater than the increase in costs.**

Question 141: When using a contribution margin format for internal reporting purposes, the major distinction between segment manager performance and segment performance is:

- a) Unallocated fixed costs.
- b) Direct variable costs of producing the product.
- c) Direct fixed costs controllable by the segment manager.
- d) Direct fixed costs controllable by others.

(CMA Adapted)



Question 142: Consider the following information for Richardson Co. for the prior year:

- The company produced 1,000 units and sold 900, both as budgeted.
- There were no beginning or ending work-in-process and no beginning finished goods inventory.
- Budgeted and actual fixed costs were equal, all variable manufacturing costs were affected by production volume only, and all selling variable costs were affected by sales volume only.
- Budgeted per unit revenues and costs were as follows:

Sales price	\$100
Direct materials	30
Direct labor	20
Other variable manufacturing costs	10
Fixed manufacturing costs	5
Variable selling costs	12
Fixed selling costs (\$3,600 total)	4
Fixed administrative costs (\$1,800 total)	2

The contribution margin earned by Richardson for the prior year was:

- a) \$25,200
- b) \$28,000
- c) \$31,500
- d) \$35,000

(CMA Adapted)

## Transfer Pricing

A transfer price is the price charged by one sub-unit of a company to another sub-unit of the same company for the services or goods produced by the first sub-unit and "sold" to the second sub-unit. The product or service that is sold and purchased internally is called an **intermediate product**. It may be used as a component of a product that is sold to the final customer by the center that purchased it internally, or the center that purchased it may sell it outright to the final customer.

Transfer pricing is most common in firms that are vertically integrated; that is, they are engaged in several different value-creating operations for a product. For example, Division A produces components for a product manufactured by Division B. Division A and Division B are both profit or investment centers.

When transfers of goods or services are made from one profit center to another profit center within the same company, the revenue received for the transfer by the selling division is a cost to the buying division. The internal transaction is eliminated when the financial statements are consolidated.<sup>53</sup> The net income for the consolidated firm includes only the revenue received from the sale to the final customer and the cost to manufacture the item. The difference between the external revenue and the internal expense is the company's consolidated gross profit. Therefore, the transfer price used has no effect on the net income of the consolidated firm.

However, the price at which the transfer takes place does affect the earnings reported by the participating divisions. If the transfer price used is not the market price, the discrepancy can distort reported divisional profits and cause them to be a poor guide for cost center performance evaluation.

As long as the selling division has the necessary unused capacity, the company as a whole usually benefits when one division of the company supplies a good or a service to another division of the same company, because the cost to the selling division to produce or provide the item will usually be lower than the company would have to pay to purchase the same item externally. The benefit the company as a whole gains from

<sup>53</sup> See *Equity Method for Investments in Equity Securities* and *Consolidation Method for Investments in Equity Securities*.

having one sub-unit provide an item to another sub-unit should be divided between the selling division and the purchasing division by means of the transfer price used. Both divisions should benefit from the company's supplying its needed goods and services internally. The selling division's markup may be slightly less than it would be if it were to sell the same thing to an external customer. As long as the units the selling division sells internally are units it would not have sold otherwise, its profit is improved. In addition, if the transfer price is set correctly, the cost to the purchasing division will be lower than if it had bought the item externally, so the purchasing division's profit is also improved.

The transfer price used should motivate division managers to make decisions that will provide the greatest benefit to the company while at the same time fairly rewarding the managers. Goal congruence is needed among the various divisions and between the divisions and senior management, and management of the company needs to be committed to achieving company goals. The transfer price used can help to achieve goal congruence.

Thus, a proper transfer price can motivate both the selling and the purchasing division managers to make decisions that provide the greatest benefit to the company, since the decisions that provide the greatest benefit to the company will also provide the greatest benefit to the managers. In this way, a properly established transfer price promotes goal congruence.

**Examples** showing why the transfer price charged has no effect on the net income of the consolidated firm and why the corporation is better off sourcing the component internally as long as it has unused capacity:

#### Example #1:

Consolidated Lamp Corporation operates two divisions: Eastern Division and Western Division. Eastern Division manufactures LED light bulbs and sells them to Western Division to use in its production of desk lamps. Western Division sells the desk lamps in a competitive market.

In addition to selling LED light bulbs to Western Division, Eastern Division sells LED bulbs to outside customers. Several competitors of Consolidated Lamp Corporation's Eastern Division manufacture an LED light bulb that is virtually identical to the Eastern Division's, so the market for LED light bulbs is also a competitive one.

During 20X8, Eastern sold 10,000 LED bulbs to Western at a transfer price of \$10.00 each. Eastern's cost of sales for the bulbs was \$6.50 per bulb. Eastern also sold 20,000 LED bulbs to external customers at the same price: \$10.00 each.

Western uses one light bulb in each desk lamp it sells, and its selling price for desk lamps is \$50.00 per unit. Western sold 10,000 desk lamps during 20X8. The cost of the other components and the labor Western uses in each of the desk lamps was \$25.00.

Here is a partial income statement for the two divisions and the consolidated company for 20X8:

	<u>Eastern</u>	<u>Western</u>	<u>Eliminations</u>	<u>Consolidated</u>
Sales revenue:				
10,000 light bulbs sold to Western @ \$10	\$100,000		(100,000)	\$ 0
20,000 light bulbs sold externally @ \$10	200,000			200,000
10,000 desk lamps sold by Western @ \$50		\$500,000		500,000
Cost of Sales:				
Cost of light bulbs sold by Eastern:				
Cost of bulbs sold to Western (10,000 × \$6.50)	65,000			65,000
Cost of bulbs sold externally (20,000 × \$6.50)	130,000			130,000
Cost of desk lamps sold by Western:				
Cost of light bulbs to Western (10,000 × \$10)		100,000	(100,000)	0
Other manufacturing costs (10,000 × \$25)		<u>250,000</u>		<u>250,000</u>
Gross profit	\$105,000	\$150,000		\$255,000
Gross profit margin	35%	30%		36.4%

(Continued)

Notice that the Eastern's income from the sale of the light bulbs to Western has been eliminated and that the cost Western paid Eastern for the light bulbs has also been eliminated. The consolidated gross profit is \$255,000, and that is equal to the sum of the gross profits for Eastern and Western, but the consolidated sales revenue has not been inflated by the sales made by Eastern to Western and the consolidated cost of sales has not been inflated by the cost of the light bulbs purchased by Western from Eastern.

**Example #2:**

The manager of the Western Division is unhappy because Western Division's gross profit margin is lower than Eastern Division's gross profit margin. For 20X9, the manager of the Western Division wants to pay a lower transfer price to Eastern Division for the light bulbs in order to improve the division's gross profit margin. The two managers negotiate, and Eastern agrees to accept \$8.85 each for the lamps it sells to Western, although it could earn \$10.00 for each lamp sold to an external customer. Everything else being equal, the partial income statement for 20X9 will look like the following:

	<u>Eastern</u>	<u>Western</u>	<u>Eliminations</u>	<u>Consolidated</u>
Sales revenue:				
10,000 light bulbs sold to Western @ \$8.85	\$ 88,500		(88,500)	\$ 0
20,000 light bulbs sold externally @ \$10	200,000			200,000
10,000 desk lamps sold by Western @ \$50		\$500,000		500,000
Cost of Sales:				
Cost of light bulbs sold by Eastern:				
Cost of bulbs sold to Western (10,000 × \$6.50)	65,000			65,000
Cost of bulbs sold externally (20,000 × \$6.50)	130,000			130,000
Cost of desk lamps sold by Western:				
Cost of light bulbs to Western (10,000 × \$8.85)		88,500	(88,500)	0
Other manufacturing costs (10,000 × \$25)		<u>250,000</u>		<u>250,000</u>
Gross profit	\$ 93,500	\$161,500		\$255,000
Gross profit margin	32.4%	32.3%		36.4%

The consolidated gross profit is exactly the same as in 20X8—\$255,000—but Eastern's gross profit and gross profit margin have decreased while Western's gross profit and gross profit margin have increased.

**Example #3:**

Instead of agreeing to accept a lower transfer price for the bulbs for 20X9, the manager of the Eastern Division insists on keeping the transfer price at \$10.00. The manager of the Western Division begins looking for a less expensive supplier of LED bulbs. It finds LED bulbs it can purchase from Competitor Company for \$9.00 and purchases 10,000 bulbs for its 20X9 production.

Eastern is not able to find another customer to take Western's place. Eastern now has some unused capacity, and Eastern's cost of sales in 20X8 for the bulbs included \$15,000 of fixed costs that are unavoidable. Therefore, Eastern's cost per unit for the bulbs it sells externally increases to \$6.75 for 20X9. Now, the partial consolidated income statement for 20X9 looks like the following:

	<u>Eastern</u>	<u>Western</u>	<u>Eliminations</u>	<u>Consolidated</u>
Sales revenue:				
20,000 light bulbs sold by Eastern @ \$10	\$200,000			\$200,000
10,000 desk lamps sold by Western @ \$50		\$500,000		500,000
Cost of Sales:				
Cost of light bulbs sold by Eastern:				
Cost of light bulbs (20,000 × \$6.75)	135,000			135,000
Cost of desk lamps sold by Western:				
Cost of light bulbs to Western (10,000 × \$9)		90,000		90,000
Other manufacturing costs (10,000 × \$25)		<u>250,000</u>		<u>250,000</u>
Gross profit	\$ 65,000	\$160,000		\$225,000
Gross profit margin	32.5%	32.0%		32.1%

(Continued)

The manager of Western Division is pleased because he has reduced the division's cost of sales and increased its gross profit margin to 32%. However, the CEO of Consolidated Lamp Corporation is not pleased. Eastern's gross profit and gross profit margin have decreased because of the loss of Western's business and the fact that it now has unused fixed assets, the cost of which must be absorbed by its sales to external customers. The effect on the gross profit for the consolidated company has been negative. By going outside to achieve an increase of \$10,000 in Western Division's gross profit (from \$150,000 to \$160,000), the manager of the Western Division has caused Consolidated Lamp Corporation's consolidated gross profit to decline by \$30,000 (from \$255,000 to \$225,000) and its gross profit margin to decline from 36.4% to 32.1%.

**Example #4:** If Eastern Division is able to replace the lost sales to Western with new external sales at \$10 per unit, the cost per unit for the light bulbs it manufactures will remain at \$6.50 per unit because Eastern Division will not have the unused capacity. This is what the income statement will look like for 20X9:

	<u>Eastern</u>	<u>Western</u>	<u>Eliminations</u>	<u>Consolidated</u>
Sales revenue:				
30,000 light bulbs sold by Eastern @ \$10	\$300,000			\$300,000
10,000 desk lamps sold by Western @ \$50		\$500,000		500,000
Cost of Sales:				
Cost of light bulbs sold by Eastern:				
Cost of light bulbs (30,000 × \$6.50)	195,000			195,000
Cost of desk lamps sold by Western:				
Cost of light bulbs to Western (10,000 × \$9)		90,000		90,000
Other manufacturing costs (10,000 × \$25)		<u>250,000</u>		<u>250,000</u>
Gross profit	\$105,000	\$160,000		\$265,000
Gross profit margin	35.0%	32.0%		33.13%

The consolidated gross profit is higher than it was when the light bulbs were being manufactured internally (\$265,000 compared with \$255,000). However, the gross profit margin for the consolidated company is below what it was before (33.13% compared to 36.4%).

**Note:** Cost centers incur only costs and do not have revenues. Thus, a cost center does not have a goal of making a profit. When a cost center's costs are allocated to users, the cost center is simply passing along the costs of its service. Therefore, the allocation of a cost center's expenses to user departments is not considered "transfer pricing" in the context being discussed here.

## Multinational Transfer Pricing and Taxes

For a multinational company with subsidiaries in different countries, the transfer price charged by a subsidiary in one country to a subsidiary in a different country causes tax consequences that affect the whole company. Different countries have different income tax rates.

Transactions between subsidiaries of multinational corporations are supposed to be priced as "arm's-length" transactions. In other words, **the prices should be the same as they would be if the two parties were not related and should not be adjusted simply to shift income between countries to reduce the overall tax payment.**

**Examples:** Consider the Eastern and Western Divisions of Consolidated Lamp Corporation. Eastern Division is in Italy, whereas Western Division is in Spain. The income tax rate in Italy is 31%, and the income tax rate in Spain is 25%. Below are the income taxes due under the first two scenarios in the previous example.

**Note: Do not try this as a means of lowering the tax burden!** The following examples are presented only to demonstrate the effect of different tax rates and how the tax due can be affected by the transfer price charged by a division in one country to a division in another country. The taxing authorities have regulations that **prohibit** adjusting transfer prices simply to move profits from one country to another in order to decrease income taxes.

**Example #1:**

Below is the gross profit before tax for the two divisions and the consolidated company for 20X8 using a transfer price of \$3.50 for the widgets, the applicable tax to each taxing authority, and the net after-tax gross profit for each division and the consolidated company:

	Eastern Div. (Italy) <u>Tax Rate 31%</u>	Western Div. (Spain) <u>Tax Rate 25%</u>	<u>Eliminations</u>	<u>Consolidated</u>
Gross profit	\$105,000	\$150,000		\$255,000
Income tax applicable	<u>32,550</u>	<u>37,500</u>		<u>70,050</u>
Net after-tax gross profit	\$72,450	\$112,500		\$184,950

The effective tax rate for the consolidated company is 27.5%.

**Example #2:**

Below is the gross profit before tax, the applicable tax, and the net after-tax gross profit for the two divisions and the consolidated company for 20X9 using a transfer price of \$8.85 for the LED light bulbs:

	Eastern Div. (Italy) <u>Tax Rate 31%</u>	Western Div. (Spain) <u>Tax Rate 25%</u>	<u>Eliminations</u>	<u>Consolidated</u>
Gross profit	\$93,500	\$161,500		\$255,000
Income tax applicable	<u>28,985</u>	<u>40,375</u>		<u>69,360</u>
Net after-tax gross profit	\$64,515	\$121,125		\$185,640

The effective tax rate for the consolidated company has decreased to 27.2%. With more income in the division with the lower tax rate (Spain), the consolidated tax bill is lower and the net after-tax gross profit is higher.

**The above example does not constitute a recommendation, so please do not try this to lower a corporation's total effective tax rate.** At one time not too long ago, multinational corporations were able to manipulate transfer prices to decrease their taxes. However, today the taxing authorities have strict regulations that **prohibit** adjusting transfer prices simply to move taxable income from one country to another to decrease income taxes, because of course it decreases their tax revenues. In the U.S., Section 482 of the Internal Revenue Code requires that transfer prices between a U.S. company and a segment of the same company in a foreign country be equal to the price that would be charged by an unrelated third party in a similar transaction (an arm's-length transaction). Other countries have similar tax regulations.

### Multinational Transfer Pricing and Tariffs and Customs

Tariffs and customs duties charged on import of products into a country also create compliance risk for a multinational company. The issues are similar to income tax considerations. Companies that are shipping products from a unit in one country to another unit in a different country may be tempted to lower the

transfer price on products imported into a country in order to lower the tariffs and customs duties charged on those products. The customs authorities are well aware of this and customs auditors look for prices that are lower than a market price in an arms-length transaction.

**Note:** Exchange rates between currencies, differing currency laws or tariff laws from one country to another, or the differing availability of materials or labor from country to country can all cause distortions in actual performance of individual subsidiaries. When assessing the performance of each of its subsidiaries impacted by these factors, the multinational corporation needs to take these distortions into consideration.

**Exam Tip:** Transfer pricing is also very important in the evaluation of different responsibility centers and their managers. These evaluation issues of transfer pricing are usually the topic of exam questions about transfer pricing.

### Transfer Pricing Objectives

Since multiple management objectives are involved in setting transfer prices, it can be extremely difficult to establish well-balanced intra-company transfer prices. Any transfer pricing system needs to accomplish the following:

- It should promote goal congruence.
- It should motivate the profit center managers to pursue their own profit goals while also working toward the success of the entire company. The selling division should be motivated to hold its costs down, and the buying division should be motivated to acquire and use the inputs efficiently.
- It should help senior managers evaluate the performance of individual sub-units.
- It should preserve autonomy<sup>54</sup> in decision making among managers of divisions, if senior management wants a decentralized organization.
- It should be equitable, permitting each unit of a company to earn a fair profit for the functions it performs.
- It should meet legal and external reporting requirements.
- It should be easy to apply.

### Methods of Setting the Transfer Price

Companies have several choices of methods for calculating the transfer price of a product or service. Generally, **top management** chooses the method of setting transfer prices and the decision should take into account the goals of the entire company, maintain motivation of the affected divisions and division managers, and remain within legal and regulatory guidelines. The more common methods are:

- Market price
- Cost of production plus opportunity cost
- Variable cost
- Full cost
- Cost plus
- Negotiated price
- Arbitrary pricing
- Dual-rate pricing

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<sup>54</sup> "Autonomy" refers to a manager's freedom to make decisions. The greater the manager's freedom is to make decisions, the greater is the manager's autonomy.

### 1) Market Price

Market price is a transfer price equal to the current or market price of the selling division's product in an "arm's-length" transaction. In other words, the transfer price is set as if the selling division were selling to an outside customer, even though the selling division is really selling to another division of the same company.

When the selling division has an external market for the product, market price is almost always the **best transfer price** to use for profitability and performance measurement because it is objective. **A market price satisfies the "arm's length" requirement by taxing authorities.** Furthermore, it assures the management of the buying division that they are paying a fair price for the goods while assuring the management of the selling division that they are receiving a fair price for the goods.

However, sometimes there is no external market to help set a given transfer price and thus a market price is not available. Another drawback of the market-price method is that each transfer of product entails profit and loss. Determining the actual cost of the final product may be difficult because the price is different from the costs of production. Furthermore, intra-company profit must be eliminated from inventories when consolidated financial statements and the income tax return are prepared.

**Note:** Transfer price methods numbered 2 through 5 that follow are based on the production cost to the selling division. All cost-based methods have a significant weakness in that the producing division is not motivated to reduce the cost of production because they know that the purchasing division will have to pay for the costs incurred in production. These cost-based methods create great risk for the company because costs for the company as a whole can get out of control.

### 2) Cost of Production Plus Opportunity Cost

The cost of production plus opportunity cost includes the cost of production (outlay cost) and the profit margin that the selling division is giving up by selling the product internally rather than externally. Though the cost of production plus opportunity cost may be very close to the market price, it is not exactly a market price because a true market price may only be set in an "arm's length" transaction, which this clearly is not.

### 3) Variable Cost

The variable cost method uses only the selling division's variable costs as the transfer price. Variable cost works well if the selling division has excess (unused) capacity and if the main objective of the transfer price is to satisfy the internal demand for goods. The variable cost method is not appropriate if the seller is a profit or investment center and does not have excess capacity, because selling at its variable cost will decrease the seller's profitability because the selling division could have earned greater profits had it sold the units externally. Therefore, when the selling division does not have excess capacity, the selling division will prefer to sell to an outside customer if the variable cost method is used to set the transfer price. However, a transfer price equal to variable cost encourages the buying division to purchase the item internally.

### 4) Full Cost

The full cost method includes all materials, labor, and a full allocation of overhead in determining a transfer price. The full cost of production is calculated using absorption costing. The advantages of using full cost as the transfer price are that it is well understood by the managers of both the buying and the selling divisions and the cost information is easily available in the accounting records. Because the product is transferred at cost, there is no need to eliminate intra-company profits from inventories in consolidated financial statements and income tax returns. Furthermore, the transferred cost can be easily used to compare actual and budgeted costs.

However, because it includes fixed costs, full cost can be misleading and cause poor decision-making. Full cost is not appropriate for decentralized companies that need to measure the profitability and performance of different profit centers. If full cost is used, the transfer price may well be higher than the buying division would pay if it were to purchase the item externally. As a result, the buying division will prefer to purchase the item outside. However, the external price may be greater than the selling division's variable cost for the



item. Since the company's fixed production costs will be the same whether the part is manufactured internally or purchased outside, the consolidated profit of the firm will be lower if the purchasing division buys the item outside.

### 5) Cost Plus

Under the cost plus method of setting transfer prices, the selling division adds either a fixed dollar amount or a percentage of costs to the cost of production to approximate a normal profit markup. This method can be used when a market price is not available. The amount used as the "cost" includes variable costs and fixed costs for production and also for selling and administrative expenses. Average variable cost (including variable selling and administrative costs) plus an allocation of all fixed costs is used as the "cost," and a percentage of that amount is added as a markup.

Either standard (or budgeted) costs or actual costs may be used in calculating the "cost." If **standard costs** are used, then there will be an opportunity to separate out variances between actual costs incurred and standard or budgeted costs. If **actual costs** are used, then there is no motivation for the manager of the producing and selling division to control the division's costs, since whatever costs are incurred will be passed on to the purchasing division. If the profit markup is a percentage of cost, it actually gives the selling division an incentive to inflate the cost through production inefficiencies and excessive allocation of common costs.

**Note:** Cost plus is what is generally used in government contracts in the U.S. The U.S. government set up a commission to determine what the cost of production is for government contracts and what can be included as a cost in this calculation.

### 6) Negotiated Price

In order for negotiation to work in setting transfer prices, each division or unit must have the ability to determine the amount of its materials that it buys or the amount of its output that it sells. Negotiation is most useful when the products in a market are rapidly changing and the companies need to be able to react quickly to changes in the marketplace. It can also be helpful if the sub-units are having a conflict and negotiation can bring about a resolution. However, in order for negotiation to be effective, neither negotiating party should have an unfair bargaining position over the other.

A drawback of this method is that negotiation can be time-consuming and require frequent revision of transfer prices due to changing costs and market conditions. The time required for negotiation diverts the attention of division managers away from more productive activities that would benefit the company and focuses their attention on activities that benefit the division instead. Also, the resulting division profits may be more a measurement of the manager's negotiating ability than the division's productive efficiency.

### 7) Arbitrary Pricing

Transfer prices may simply be set by central management to achieve some overall objective. The advantage to this method is that the price achieves the objectives that central management considers most important. The disadvantages of this method far outweigh the advantages, however, because arbitrary pricing defeats the goal of making divisional managers profit-conscious. It hampers their autonomy as well as their profit incentive.

### 8) Dual-Rate Pricing

Dual-rate pricing is a method in which the selling and the purchasing divisions each record the transaction at different prices. For example, the seller records the transfer price at market value, but the purchasing department records it at the variable cost of production. As a result, each division's financial results appear more positive, at least on paper. With dual-rate pricing, the sum of the divisional profit amounts will be greater than the profit for the company as a whole. The profit assigned to the producing division will need to be eliminated when the consolidated financial statements and income tax returns are prepared.



The advantage of dual-rate pricing is that the selling division has an incentive to expand sales and production. At the same time, the buying division gets to book the product's purchase at its actual cost to the firm. Thus the buying division's costs do not include an artificial profit for the selling division. Variable cost is therefore used for decision-making but market price is used for evaluation.

The main disadvantage of this system is that it is complex. There is inherent difficulty in evaluating the relative performance of the selling and the buying divisions because their profits have been determined on different bases.

### Deciding Which Method to Use

**Note:** Theoretically, a market price is the best method for determining a transfer price, as use of a market transfer price essentially treats all internal divisions as though they were separate companies.

When deciding which method to use, management will generally consider a number of factors. The most common factors are the following:

- The **goals of the company** and what method will best enable those goals to be met (goal congruence), and
- Factors relating to the **capacity of the producing division**, its ability to sell the product on the open market, and the ability of the purchasing division to buy the product on an open market.

Ultimately, the selling division should be able to recover its costs plus an opportunity cost, if applicable, and the purchasing division should not be required to pay more than it would pay on the open market. An opportunity cost would be applicable if the selling division were operating at capacity and thus would be forced to decline orders from outside customers to fulfill the needs of the internal purchasing division. The opportunity cost is the contribution margin the selling division could have earned on the external sales lost as a result of fulfilling the internal division's requirements instead of selling to the outside customer.

Usually, the transfer should be done at the market price, as only the market price will satisfy both objectives above. However, in some situations a price below the market price would still be beneficial to both divisions as well as to the firm as a whole. Such a situation will occur if the selling division has excess capacity, because whatever contribution margin it earns from the internal sale will improve its profit.

If the selling division has excess capacity, transferring the goods at a price that is only \$1 greater than its variable cost of production makes sense. In doing so, the selling division will have a greater contribution and thus a greater profit than it would have had otherwise, and the purchasing division will have a lower cost of production because the internal transfer price is lower than the market price.

However, if the selling division does not have excess capacity, then the transfer price must be high enough to cover the selling division's variable costs of production plus the contribution that it will lose by having to cancel an existing order for it to be willing to sell internally. This situation is illustrated in the example below for Blitz Corporation.

**Note:** The purchasing division management will prefer to buy from the source that has the lowest price, whether that source is internal or external. However, senior management of the company will look at the question based upon the variable costs of production for the internal supplier. The fixed costs of the internal supplier are a sunk cost and will not change no matter where the purchasing division buys the units. Therefore, even if the transfer price is higher than an outside supplier's price, the company as a whole will be better off if the purchasing division buys internally if the variable costs of the internal supplier are lower than the price charged by the external supplier.

Even though the purchasing division will be worse off for having bought internally, the company as a whole will be better off than it would have been if the purchasing division had bought externally.

**Example:** Blitz Corporation has two divisions, A and B. Division B currently operates at 100% of its capacity and produces two products: widgets and gadgets. Division B sells both products to outside customers for \$15 and \$30 per unit, respectively. The variable costs for widgets are \$10 per unit and fixed costs are \$3 per unit at the current production and sales level. For gadgets, the variable costs are \$16 per unit and fixed costs are \$8 at the current production and sales level.

Division A, which currently purchases widgets from an outside supplier for \$16 per unit, would like to purchase 150 widgets from Division B annually. However, if Division B increases its production of widgets to meet the demand of Division A, it must stop producing gadgets entirely. Also, to meet stricter quality requirements of Division A, Division B must increase materials cost by \$0.80 per widget, but the marketing and transportation cost per widget will be reduced by \$0.50 per unit. The total number of units of gadgets produced and sold by Division B is 50 units per year.

What is the price range within which the transfer price for widgets would satisfy both divisions?

**Solution:**

The transfer price acceptable for the seller, the buyer, and the whole company should be:

- 1) **higher** than the **variable costs (VC) plus the opportunity cost (OC) of forgone production and sales** for the seller (lost contribution margin) per unit. This is the minimum price that the selling department needs to receive, and
- 2) **lower** than the **market price of the product** per unit. This is the maximum amount that the buying department would be willing to pay.

Expressed as a formula:

$$\text{VC} + \text{OC} \leq \text{Transfer Price} \leq \text{Market Price}$$

We need to solve for the variable cost, opportunity cost, and market price.

**Variable cost** for widgets produced by Division B for Division A is **\$10.30** per unit ( $\$10 + \$0.80 - \$0.50$ ).

The contribution margin lost on each gadget that Division B could not produce is  $\$30 - \$16 = \$14$ . Therefore, the total contribution margin lost by Division B for the 50 gadgets that would not be produced if it sells widgets to Division A is \$700 (50 units  $\times$  \$14 per unit). The **opportunity cost** that is given up for the production of each widget for Division A is **\$4.67** ( $\$700 \div 150$  units).

Adding the variable costs per unit and the opportunity cost per unit together, we get the **minimum transfer price of \$14.97** (\$10.30 variable costs + \$4.67 opportunity cost).

The **market price (the maximum transfer price) for a widget is \$16**.

The optimal transfer price for all parties must be between \$14.97 and \$16. Any price lower than \$14.97 will not be acceptable to Division B, and any price higher than \$16 will not be optimal for Division A because Division A could buy widgets at a lower price on the open market.

Question 143: A limitation of transfer prices based on actual cost is that they

- a) Lack clarity and administrative convenience.
- b) Charge inefficiencies to the department that is transferring the goods.
- c) Must be adjusted by some markup.
- d) Can lead to suboptimal decisions for the company as a whole.

(CIA Adapted)

Question 144: Division Z of a company produces a component that it currently sells to outside customers for \$20 per unit. At its current level of production, which is 60% of capacity, Division Z's fixed cost of producing this component is \$5 per unit and its variable cost is \$12 per unit. Division Y of the same company would like to purchase this component from Division Z for \$10. Division Z has enough excess capacity to fill Division Y's requirements. The managers of both divisions are compensated based upon reported profits. Which of the following transfer prices will maximize total company profits and be most equitable to the managers of Division Y and Division Z?

- a) \$12 per unit.
- b) \$22 per unit.
- c) \$20 per unit.
- d) \$18 per unit.

(CIA Adapted)

Question 145: Division A of a company is currently operating at 50% capacity. It produces a single product and sells all its production to outside customers for \$13 per unit. Variable costs are \$7 per unit, and fixed costs are \$6 per unit at the current production level. Division B, which currently purchases this product from an outside supplier for \$12 per unit, would like to purchase the product from Division A. Division A will operate at 80% capacity to meet the demand of outside customers and Division B. What is the **minimum** price that Division A should charge Division B for this product?

- a) \$9.60 per unit.
- b) \$12.00 per unit.
- c) \$13.00 per unit.
- d) \$7.00 per unit.

(CIA Adapted)

Question 146: The alpha division of a company, which is operating at capacity, produces and sells 1,000 units of a certain electronic component in a perfectly competitive market. Revenue and cost data are as follows:

Sales	\$50,000
Variable costs	34,000
Fixed costs	12,000

The **minimum** transfer price that should be charged to the beta division of the same company for each component is:

- a) \$12
- b) \$50
- c) \$46
- d) \$34

(CIA Adapted)

Question 147: The Eastern division sells goods internally to the Western division of the same company. The quoted external price in industry publications from a supplier near Eastern is \$200 per ton plus transportation. It costs \$20 per ton to transport the goods to Western. Eastern's actual market cost per ton to buy the direct materials to make the transferred product is \$100. Actual per ton direct labor is \$50. Other actual costs of storage and handling are \$40. The company president selects a \$220 transfer price. This is an example of:

- a) Negotiated transfer pricing.
- b) Cost plus 20% transfer pricing.
- c) Cost-based transfer pricing.
- d) Market-based transfer pricing.

(CIA Adapted)

## Performance Measures

### Strategic Issues in Performance Measurement

Companies need to measure performance and reward outstanding performance in a way that motivates its managers to achieve the **company's** strategic objectives and operational goals. If the performance measurement system rewards managers for achieving only their own units' goals, it is quite possible that managers will maximize their own units' performance without necessarily maximizing the company's performance. Therefore, performance evaluation measures should be directly related to the company's strategic objectives and operational goals. The company's specific performance targets (such as increasing market share in key customer segments, reducing costs, or providing innovative products and services) need to be reinforced by the management reward system so that managers' rewards are dependent upon achieving the target performance.

The Budgeting section defined "goal congruence" as "aligning of goals of the individual managers with the goals of the organization as a whole." "Goal congruence" means that individuals and organization segments are all working toward achieving the organization's goals. It also means that managers who are working on behalf of their own best interest are taking actions that accomplish the overall goals of the company's senior management. It is important to evaluate managers on their achievement of goals that benefit the **company**, not on goals that benefit only their own department or division.

Another strategic issue in performance measurement is the balance between short-term versus long-term focus. Too much emphasis on the current quarter's results will nearly always cause managers to eliminate or postpone activities that are vital for the firm's long-term success in order to improve short-term profits. If the long-term focus is lost, the business's future success will be endangered. For example, a pharmaceutical company could improve its current results by cutting back on new drug R&D, but eventually its existing drug patents will expire, and with no new drugs in the pipeline as new sources of revenue the company will be exposed to competition from generic drugs.

### Timing of Feedback

An important part of any performance measurement system is the feedback it generates. The timing of the feedback is important because feedback that is not received in a timely manner is not useful. The proper timing of the feedback depends on who should receive the information, the importance of the information, and the content of the feedback.

For example, managers who are responsible for profit centers need information about their sales volumes quickly, usually on a daily or a weekly basis, particularly in a business with high fixed costs. When a manager is responsible for generating adequate sales to cover high fixed expenses, he or she needs to know immediately if sales decline so that actions can be taken to reverse the decline. However, daily or weekly sales information would probably be too frequent for top management. Top management may need sales information only on a monthly basis; although, if there is any cause for concern, they may need information more frequently.

### Performance Measures Should be Related to Cost and Revenue Drivers

A cost driver is anything (such as an activity, an event, or a volume of something) that causes costs to be incurred each time the driver occurs. If a performance measure involves costs, then the company needs to evaluate its processes that cause those costs, not just the costs themselves.

**Example:** Packaging is one example of a cost driver. If the company's goal is to minimize packaging costs, then it needs to have standards for the amount it should pay for boxes and bubble wrap or other padding materials. The actual costs should be compared against those standards, and the causes of variances should be investigated as part of the performance measurement system. The cause of an unfavorable variance in packaging costs may be that too much bubble wrap was used for the items that were shipped, and the reason may be that, in an attempt to save money, the shipping boxes used were too flimsy and thus required extra bubble wrap to prevent damage. If the cost for the additional bubble wrap was greater than the amount saved by buying the flimsy boxes, then the decision to purchase cheaper boxes was not a good one and should be changed. Just looking at "packaging costs" without considering the causes, or drivers, of packaging costs will not identify the cause of an unfavorable variance.

Anything that creates revenue is a revenue driver. Units of output sold, selling prices, and marketing activities are all examples of revenue drivers. Therefore, revenue performance measurements need to focus on things like units of output, sales volume, selling prices, and marketing activities. The performance measurement system needs to compare actual activities with planned levels of activities, not simply measure actual revenue in comparison with planned revenue. Focusing on the revenue drivers will help the company identify the causes of unfavorable variances. Perhaps sales were down because of an economic recession, or perhaps a competitor introduced a new product that directly competed with one of the company's own products.

If the cause (or driver) of the lower revenue is not identified, then the decreased revenue cannot be addressed.

## Performance Measurement

In the topic of *Responsibility Centers and Reporting Segments*, we looked at the contribution income statement as a means of evaluating the performance of reporting segments and segment managers. The financial success of a segment and the performance of its manager can be measured in other ways besides the contribution income statement. Return on Investment (ROI) and Residual Income (RI) are the primary means of financial measurement that are important to know. You need to know what each one is, how each is calculated, how each one is interpreted, and how they compare with each other.

Each of these methods by itself measures only one thing, and therefore one method by itself does not provide a complete evaluation of a manager or a department.

**Note:** In addition to these numerical and financial-based measures, it is also critical for the evaluation process to include non-financial measures such as customer satisfaction, quality reports and employee turnover. Other measures that are specific to the business or individual job should also be included.

## Return on Investment (ROI)

Return on Investment (ROI) can be used to evaluate the performance of the entire firm, but it can also be used to evaluate the performance of single divisions and their division managers.

**ROI is the key performance measure for an investment center.** It measures the percentage of return that was provided on the dollar amount of the investment (that is, assets). The calculation is:

$$\frac{\text{Income of the Business Unit}}{\text{Assets (Investment) of the Business Unit}}$$

**Note:** For performance measurement, "Income" means **operating income** unless otherwise stated.

**Note:** The exam questions will not require you to calculate an average of the assets of the business unit for the denominator. Just use the assets figure as given in the problem.

If an income amount is for less than a one-year period, it should be **annualized** to present the amount as if the same income level had been attained for a full year. To annualize an income amount covering less than a full one-year period, multiply the income amount by the appropriate number. For example, if the income amount is for one quarter, multiply the quarterly amount by 4 to annualize it. If the income amount is for one month, multiply the monthly amount by 12 to annualize it. If the income amount is for five months, first divide it by 5 to calculate a monthly amount and then multiply that monthly amount by 12.

**It is especially important to annualize income when an annual percentage rate of return is being calculated.**

If ROI is used as an evaluation tool, management must be certain that it is the correct measurement for the company's goals and that the ROI goals are representative of that individual department's market and business.

A manager can use ROI to determine if the division should accept a capital investment or project. If the ROI of the project is higher than the target or required return (or hurdle rate), the manager will accept the project. Conversely, if the ROI is lower than the required rate of return, the manager will reject the project, even if the project itself is profitable.

#### Disadvantages of Using ROI for Performance Measurement

**The problem with ROI as a performance measurement that it measures return as a percentage rather than as a dollar amount.** If the expected ROI of a new project under consideration is lower than the division's present ROI but higher than the target rate, the manager may reject a profitable project because it would lower the division's overall ROI, even though the project would be beneficial for the company. While it is good to have a higher rate of return, the company is ultimately interested in the **amount** of the return. Any project with a return higher than the company's required rate of return will increase the company's net profit, even though it may reduce that division's ROI (that is, if the division's current ROI is higher than the expected ROI of the new project). As a result of this shortcoming, ROI is often used together with other measurement tools.

Another **disadvantage** of using ROI for performance measurement is that when a manager is evaluated using current ROI, the pressure to meet the current period's ROI target may cause short-term profits to take precedence over long-term profits. In the long term, this imbalance can lead to **reduced** performance, such as a manager reducing R&D spending, advertising, employee training, or productivity improvements in order to make current ROI look better.

### Effect of Accounting Policies on ROI

When ROI is used to evaluate individual division managers, or even the whole firm, it is important to recognize the ways in which accounting policies that affect the methods used to measure operating income and investment can affect ROI.

#### Measuring *Income* and *Investment* for ROI

The accounting policies that have the most effect on ROI relate to revenue and expense recognition and asset measurement, and five of these policies are particularly important. To maintain comparability among divisions, all divisions should use the same accounting policies in these five areas. Furthermore, top management should consider whether or not the accounting policies in use, even if standardized among divisions, may be causing operating income to be under- or overstated and/or investment to be under- or overstated throughout the organization. The five areas are:

- 1) Inventory cost flow assumptions.
- 2) Depreciation method.
- 3) Asset capitalization policy.
- 4) Use of full costing.
- 5) Disposition of manufacturing variances.

Any differences among divisions in the way that revenues, expenses, and assets are accounted for can significantly influence interpretation of the divisions' ROIs and their comparability.

#### 1) Inventory

All of the divisions need to be using the same inventory cost flow assumption (such as FIFO, Weighted Average, or LIFO). The choice will affect both operating income and total assets.

- Under FIFO (first-in, first-out), the assumption for each sale is that the inventory acquired **first** is the inventory that is sold first. Therefore, inventory on hand consists of the most recently purchased units. In a period of rising prices, ending inventory will be higher under FIFO than under any of the other cost flow assumptions. In addition, cost of goods sold will be lower than under the other cost flow assumptions, so operating income will be higher. Using FIFO usually results in higher ROI.
- Under LIFO (last-in, first-out), the assumption for each sale is that the inventory acquired **last** is the inventory that is sold first. Inventory on hand at any given moment consists of the oldest units purchased, so the value of ending inventory under LIFO will be lower than under any of the other cost flow assumptions (assuming prices are rising) and total assets will also be lower. Operating income will be lower as well because cost of goods sold will be higher. The use of LIFO usually results in lower ROI.
- Inventory and operating income under Weighted Average Cost will be in between FIFO and LIFO, and so will ROI.

Examples of ROI under the three inventory cost-flow assumptions in a period of rising prices with all other variables held constant:

	Weighted <u>Average Cost</u>	<u>FIFO</u>	<u>LIFO</u>
Average Inventory	\$ 1,000,000	\$ 1,500,000	\$ 500,000
Average Other Assets	5,000,000	5,000,000	5,000,000
Average Total Assets	6,000,000	6,500,000	5,500,000
Operating Income	1,100,000	1,600,000	600,000
ROI	0.18	0.25	0.11



## 2) Depreciation

Divisions need to be using the same method to depreciate fixed assets, and the methods used in measurement need to be fair for all of the divisions. Even though the same depreciation method may be used for all divisions, the results may still not be comparable or fair.

- Older fixed assets will have a lower book value than newer fixed assets because more depreciation has been recognized. Therefore, if the book value of fixed assets is used in Total Assets, the same dollar amount of operating income in two divisions will produce a higher ROI in the division with the older assets. Because the assets are older and their book value is lower, the denominator will be lower and the ROI will be higher. This may encourage a manager to choose not to replace fixed assets. While not replacing fixed assets will increase the division's ROI, it may not be a good decision for the company, or even that division, in the long run.
- Furthermore, depreciation expense on the older assets may be lower. If an accelerated method of depreciation is being used, more depreciation expense is recognized in the early years of the assets' lives, so operating income will be higher in the later years of the assets' lives. Older assets may even be fully depreciated, so no depreciation expense will be recognized on those assets. Lower depreciation expense will lead to a higher income and a higher ROI for the divisions with the older assets.
- For a division with older assets, a higher operating income combined with lower fixed asset values will create an unrealistically high ROI and the profitability of the division with older assets may appear to be higher than it actually is. When the assets are replaced, the current replacement value will be much higher and the ROI much more decreased. The division's operating income may not be adequate to support the replacement of the assets at their current higher value.

Problems with lack of comparability caused by different asset ages among divisions can be alleviated by using **current market value or replacement value of the assets**, rather than historical or net book value, in calculating ROI. In this way, a future profitability problem can be revealed, enabling timely corrective action. Use of current asset values will make the ROI more relevant and comparability of divisions will be restored.

## 3) Asset Capitalization Policy

Companies have policies specifying whether an item is to be expensed or capitalized as an asset when purchased, generally based on the cost. An example of an asset capitalization policy is that an asset costing \$500 or more must be capitalized, whereas an asset costing less than \$500 must be expensed. The cost level to qualify for capitalization is set by management.

When a newly purchased asset is expensed, operating income in the year of purchase is reduced by the cost of the asset and no further reduction of operating income ensues in subsequent years for that asset. When a newly purchased asset is capitalized, operating income is reduced in the year of purchase by only that year's depreciation, but operating income is also reduced in subsequent years by the depreciation recorded each year.

For ROI to be comparable among divisions, the same asset capitalization policy needs to be in effect for all divisions of the company.

## 4) Use of Full Costing

The use of full (absorption) costing will cause operating income and thus ROI to rise when inventory levels rise and to fall when inventory levels fall. Management's review of individual divisions' operating results needs to include a review of each division's inventory levels so that their operating income can be properly interpreted.

### 5) Disposition of Manufacturing Variances

Firms also have policies regarding the manner in which manufacturing variances are to be handled. The variances may be closed to cost of goods sold if they are immaterial or they may be prorated among cost of goods sold, finished goods inventory, and work-in-process inventory. The choice between expensing the variances and prorating them will affect both operating income and inventory balances.

- If variances are closed to cost of goods sold only, operating income and also inventory will be distorted and ROI will in turn be distorted. The distortion could go either way, depending upon whether the adjustment to cost of goods sold increases or decreases cost of goods sold.
- If the variances are prorated, net income and inventory will not be distorted. They will be the same as they would have been had the actual costs been allocated to production during the period instead of standard costs.

The effect that the disposition of manufacturing variances has on the financial statements is explained in more detail and examples are given in *Capacity Level and Its Effect on Financial Statements* in Section D.

### Other Income Measurement Issues

Other transactions can affect the measurement of operating income and ROI, reducing comparability among business units.

- **Nonrecurring items:** Nonrecurring charges or revenues can prevent operating income of a given business unit from being comparable to that of prior periods and from being comparable to operating income of other business units.
- **Income taxes:** Income taxes may affect various units differently, especially if the units are located in different countries with different tax rates and varying tax treaties. Even within one country, there may be different local or regional taxes.
- **Foreign exchange:** Operating income and value of investments in foreign countries can vary due to fluctuations in currency exchange rates.
- **Joint asset sharing:** Costs for common facilities or services need to be allocated on a fair basis, as discussed in *Allocation of Common Costs*. Different methods of allocating the common costs will result in different costs for each unit and thus will affect the units' operating income.

### Assets to Include in Investment

The "Ratio Definitions" document for the CMA exams published by the ICMA<sup>55</sup> states that the denominator, or "Investment," of ROI should be "assets of the business unit." But what specific assets should be included in "Investment"?

**Exam Tip:** If an exam question does not give any information other than the value of "Total Assets," then use Total Assets (or average Total Assets) without adjustment for the denominator "Investment."

In real-world business situations, however, "investment" is commonly defined as the net cost of long-lived assets (net of depreciation) plus net working capital. Net working capital is total current assets minus total current liabilities.

Other important principles to keep in mind with respect to assets included in "Investment" are:

- Only assets actually **controlled by a unit** should be included in its investment for the purposes of calculating its ROI. If current assets on the books of a division are actually controlled at a higher level in the company, they should not be included in the calculation of that division's investment, including cash, receivables, and inventory. Only the cash, receivables, and inventory controlled by the division should be included.

<sup>55</sup> This document is published by the ICMA and is available on the IMA's website at [www.imanet.org](http://www.imanet.org/cma_certification/current_cma_candidates/flexible_study_options.aspx) ([http://www.imanet.org/cma\\_certification/current\\_cma\\_candidates/flexible\\_study\\_options.aspx](http://www.imanet.org/cma_certification/current_cma_candidates/flexible_study_options.aspx)).

**Note:** This principle is based on the same concept of responsibility as was discussed in Responsibility Accounting: managers should be evaluated on only the results of decisions they can control.

- Fixed assets should be included in a division's investment only if they can be traced to that division. Problems arise when assets are leased, idle, or shared with another division.
  - **Leased assets should generally be included in "investment"** because they are assets that generate operating income. The company should have a policy addressing how leases are treated in calculating ROI.
  - **Idle assets that have alternative uses or that can be sold should generally be included in the division's "investment" amount** for calculating ROI. However, an idle-assets policy can be used to encourage managers to either sell or hold idle assets, depending on senior management's preference. Including idle assets in investment will motivate managers to sell them to reduce investment and increase the ROI. On the other hand, if top management believes holding the idle assets would be advantageous, excluding them from investment for ROI will motivate managers to hold them.
  - If **facilities are shared by two or more divisions**, management must work out a fair sharing arrangement. Assets that cannot be traced to one particular division need to be allocated on a basis that reflects actual usage by each division. Some shared facilities need to be large enough to accommodate periods of high demand. In such a circumstance, the assets shared should be allocated based on the peak demand by each division rather than on actual usage.
  - A company may have a significant amount of **intangible assets** that are not recorded in the financial statements. Under U.S. GAAP, only intangible assets that have been purchased (such as patents, copyrights, or goodwill resulting from an acquisition) may be recorded as assets. Investments in R&D will not be on the balance sheet because those must be expensed as they are incurred. Therefore, investment may be substantially undervalued on the financial statements and operating income may be distorted by the high expense for R&D. This potential distortion must be considered when evaluating a business unit's ROI.

### Valuing Assets Included in ROI

The value of investment is typically the historical cost of the assets. For current assets, the historical cost is their book value. For fixed assets, the historical cost is their net book value (that is, their historical cost less accumulated depreciation). However, the use of net book value for long-lived assets can create a problem if the long-lived assets make up a major portion of a unit's total investment.

Price changes since the purchase of the assets can cause their historical cost figures and net book values to be at best irrelevant and at worst misleading. The relatively small historical cost of the assets can cause ROI to be significantly overstated when compared with ROI calculated using the current value of the fixed assets. The inflated ROI can create illusory return on investment that will not be there when the assets are replaced in the future at their current value at that time. The amount of operating income the business unit generates may not be adequate to support the assets' replacement.

Because of the issues associated with using historical cost to value the assets, current value may be used because:

- 1) Use of current value makes it possible for the company to identify low profitability in a timely manner, whereas use of historical value can delay recognition of the problem.
- 2) The use of current value for the assets of all the business units reduces the unfairness of using net book value when the various business units have assets of different ages. When net book value is used, units with older assets will have higher ROIs than units with newer assets because the net book values of the older assets will be significantly lower than the net book values of the newer assets. If the older and the newer assets are providing equivalent service, use of net book value will be unfair to the manager of the unit with newer assets.

**The use of current value for long-lived assets is preferred** for the calculation of ROI because the use of current values improves ROI as a measure both of the economic performance of the units and of the managers' performance. Unfortunately, the decision to use current value raises the issue of how exactly the current value of the assets will be measured.

Measures that may be used for current values include: gross book value not reduced by accumulated depreciation, replacement cost, and liquidation value. All of the measures have their place, depending upon the purpose of the ROI calculation.

- **Gross book value** is the historical cost of the existing assets not reduced by accumulated depreciation. The advantage of gross book value is that it eliminates the problem of different ages of assets among business units. However, it does not reflect price increases that may have taken place since the assets were purchased. Managers who want to use a verifiable, objective number prefer gross book value.
- **Replacement cost** is the current cost to replace the assets at their current functionality. Replacement cost is preferable if ROI is used to evaluate managers and units as ongoing enterprises because it represents the cost to replace the assets currently being used.
- **Liquidation value** is what the assets would bring in a liquidation of the business. It does not represent the value of the units as ongoing enterprises because of the assumption that the business is being liquidated. Liquidation value will almost always be lower than replacement value and historical cost. However, liquidation value is useful when management is using a business unit's ROI to evaluate whether or not to dispose of the unit. In that situation, the relevant current cost would be the assets' liquidation value.

Question 148: Listed below is selected financial information for the Western Division of Hinz Company for last year:

Average working capital	\$625,000
General and admin expenses	75,000
Net sales	4,000,000
Average plant and equipment	1,775,000
Cost of goods sold	3,525,000

If Hinz treats the Western Division as an investment center for performance measurement purposes, what is the before-tax ROI for last year?

- a) 34.78%
- b) 22.54%
- c) 19.79%
- d) 16.67%

(CMA Adapted)

Question 149: The selection of the denominator in the return-on-investment (ROI) formula is critical to the measure's effectiveness. When ROI is used to evaluate the performance of individual responsibility centers, which denominator is criticized because using it combines the effects of operating decisions made at one level of the organization with financing decisions made at another organizational level?

- a) Total assets employed.
- b) Working capital.
- c) Total assets available.
- d) Shareholders' equity.

(CMA Adapted)

Question 150: Return-on-investment (ROI) is a term often used to express income earned on capital invested in a business unit. A company's ROI will increase if:

- a) Sales increase by the same dollar amount as expenses and total assets increase.
- b) Sales remain the same and expenses are reduced by the same dollar amount that total assets increase.
- c) Sales decrease by the same dollar amount that expenses increase.
- d) Sales and expenses increase by the same percentage that total assets increase.

(CMA Adapted)

Question 151: A company has four regional divisions. A summary of financial results for the company is shown below.

	<u>North</u>	<u>East</u>	<u>South</u>	<u>West</u>
Operating income	\$1,000	\$ 5,000	\$4,000	\$ 7,500
Assets	2,500	15,000	8,000	25,000
Liabilities	500	7,000	1,000	5,000
Total equity	2,000	8,000	7,000	20,000

Which division has the highest return on investment?

- a) North
- b) East
- c) South
- d) West

(ICMA 2013)

### Residual Income (RI)

Residual Income (RI) attempts to overcome the weakness in ROI by measuring the **dollar amount of return** that is provided to the company by a department or division. RI for a division is calculated as the amount of return (**operating income before taxes**) that is in excess of a **targeted amount of return** on the investments employed by that division. Residual income is the operating income earned after the division has covered the required charge for the funds that have been invested by the company in its operations.

Two items that you need to know in regard to the calculation of RI are:

- 1) The **targeted amount of return** is usually some percentage of, or rate of return on, the total employed assets of the division, or the **invested capital** in the division, and
- 2) The **percentage used** in the calculation is the **required rate of return** that management has set.

If the required rate of return is not available in the question, use the company's **weighted average cost of capital** (which will be given in the question).

Any project that has a positive RI will be accepted, even if it will reduce the overall company or division ROI.

The **formula for RI** is:

$$\begin{aligned} & \text{Operating income before taxes for the division, project, or investment opportunity} \\ & - \text{Target return in dollars: Employed assets of the business unit} \times \text{required rate of return} \\ & = \underline{\text{Residual Income}} \end{aligned}$$

**Note:** The exam questions will not require you to calculate an average of the employed assets of the business unit. Just use the assets figure as given in the problem.

In the calculation of Residual Income, the target rate of return (employed assets of the business unit  $\times$  required rate of return) is an **imputed cost** of the investment. This imputed cost is the **opportunity cost** of other potential returns that have been forgone in order to make the investment in the business assets. The target rate of return is determined by management. It **might** be equal to the weighted average cost of capital or the marginal cost of capital, but it is the required rate because it is the rate management has selected as the required rate.

**Note:** If the expected rate of return on a new investment is greater than the required rate of return (usually the cost of capital), residual income will increase, even if the expected return on investment for the new project is lower than the current return on investment.

**Note:** Idle capital assets or land should **not** be included in the amount of the investment.

**Example:** Medina Company has total assets of \$4,000,000 and operating income of \$600,000. Its target, or required, rate of return is 10%. How much residual income does Medina have?

The target return = \$4,000,000  $\times$  0.10 = \$400,000

Operating income of \$600,000 less \$400,000 target return = \$200,000 of residual income.

**Note: Residual Income may be a negative amount.** Negative Residual Income occurs when the profits that the division or project actually achieved are less than the target income that was set for the division or project.

### Advantages and Disadvantages of Using Residual Income

RI overcomes the weakness inherent in the use of ROI for manager evaluation: in the event that a project has an ROI that is lower than the unit's current ROI, the manager may reject a profitable project because it would lower the division's overall ROI, even though the project would be beneficial for the company. In contrast, RI motivates managers to maximize an absolute monetary amount (RI) instead of a percentage (ROI). As a result, as long as a project for a subunit is expected to earn an amount in excess of the charge for the funds needed for the investment, that project will be accepted. Using RI as a performance measure instead of ROI overcomes the tendency of managers to reject projects that would be profitable to the company but that would lower the business unit's current ROI. Thus, the primary advantage of RI is that **a project beneficial to the company is more likely to be selected**, even if its ROI is lower than the unit's existing ROI.

Another advantage of RI is that a firm can **adjust its required rates of return for differences in risk**. A unit with higher business risk can be evaluated using a higher required rate of return than that which is used for a unit with lower business risk.

RI also enables a company to use a **different investment charge for different classes of assets**. For example, the company could use a higher required rate of return for long-lived assets, especially if their resale value is expected to be low, and a lower required rate of return for shorter-term assets (such as inventory).

However, RI has its weaknesses. First, it focuses on the dollar amount of the return. Although a \$1 return might be beneficial for a company, the amount of the return may be so small in comparison to the amount invested that the return is not worth the effort. As such, RI is often used together with another evaluation measure.

Another disadvantage of RI is that it is difficult to compare the performance of subunits of different sizes. A large subunit would probably have a larger Residual Income than a small unit, but the smaller unit might have a higher rate of return on its employed assets despite its lower RI.

In addition, a small change in the required rate of return would have a greater absolute effect on the amount of a large unit's RI than it would on the RI of a small unit.

Furthermore, RI has the same issues as ROI with respect to distortion caused by the accounting policies selected by the company. Residual Income must be interpreted carefully because of the various effects of different accounting policies on operating income and on the amount of investment.

### Role of Accounting Methods on Performance Measurements

When assets such as inventory and fixed assets are used, their values are influenced by the chosen accounting method. For example, the value of inventory can be calculated under the FIFO, LIFO, or weighted average methods. In a comparison between two business units, it is important that both subunits use the same inventory method because use of different methods will reduce their comparability.

Using the same standards in both subunits is also applicable in any other area where different accounting methods can be used. Different methods of recognizing revenues and expenses among different business units and companies can reduce the comparability of their performance measurements. For instance, the use of absorption costing instead of variable costing will cause operating income to be higher when inventory increases because some fixed costs will be capitalized in inventory.

**Exam Tip:** For the Exam, you don't need to be able to calculate the differences that would arise from different accounting methods, but you do need to be able to recognize the issues of comparability that arise as a result of using different methods. Comparability issues were discussed at length with respect to ROI and they are applicable to RI, as well.

Question 152: Zack Corp. had the following information for 20X3:

Sales	\$500,000
Operating income	50,000
Operating assets	200,000
Imputed interest rate	10%

What amount of residual income did Zack have?

- a) \$(20,000)
- b) \$5,000
- c) \$10,000
- d) \$30,000

(HOCK)

Question 153: The imputed interest rate used in the residual income approach to performance evaluation can best be described as the:

- a) Average lending rate for the year being evaluated.
- b) Historical weighted-average cost of capital for the company.
- c) Target return-on-investment set by the company's management.
- d) Average return-on-investments for the company over the last several years.

(CMA Adapted)

Question 154: Residual income is a better measure for performance evaluation of an investment center manager than return-on-investment because:

- a) The problems associated with measuring the asset base are eliminated.
- b) Desirable investment decisions will not be neglected by high-return divisions.
- c) Only the gross book value of assets needs to be calculated.
- d) The arguments about the implicit cost of interest are eliminated.

(CMA Adapted)

Question 155: A company is considering the addition of a new product line. The new product line is expected to generate a return higher than the cost of capital, but lower than the current overall return on investment (ROI). If the company decides to add the potential new product line, residual income will

- a) increase.
- b) remain unchanged.
- c) decrease.
- d) become higher than the firm's return on investment.

(ICMA 2013)



**Weighted Average Cost of Capital (WACC)**

**Exam Tip:** In the Part 1 exam, it is **very unlikely that you will need to calculate the WACC**. If needed, the WACC will be given in the problem. The information below is offered only for those who would like to know what WACC is. Calculation of the weighted average cost of capital is covered in detail in the CMA Part 2 exam. For the Part 1 exam, you need to know that management's required rate of return is often (though not always) the company's weighted average cost of capital.

WACC is the weighted average cost of capital. It is expressed as a percentage rate, and it can be calculated as the **total cost of long-term funds** (debt and equity) divided by the **fair value** of these long-term funds.

The following formula will give you a general idea of what WACC represents. However, be aware that the formula below does not result in the actual WACC as it is calculated for the CMA Part 2 exam. The actual WACC includes a factor for growth in future dividends that is not included in this formula.

$$\frac{(\text{Interest paid on Debt} - \text{Effect of Taxes}) + \text{Dividends paid on Shares}}{\text{Average Fair Value of Debt outstanding} + \text{Fair Value of Shares outstanding}} = \text{WACC}$$

Note that the **fair values (market values)** of outstanding debt and stock are used to calculate the WACC, in contrast to the book value of balance sheet accounts used in other ratios.

**Note:** The total interest cost must take into account the **effect of taxes**. Because interest is a deductible expense, the true cost of interest (the **after-tax cost** of interest) is the amount of interest expense minus (the tax rate  $\times$  the interest amount). The after-tax cost of interest can also be calculated as the amount of interest  $\times$  (1 – the tax rate). The after-tax cost of interest is lower than the actual interest expensed by the company.

**Using ROI and RI**

On the Exam, you need to be able to calculate the Residual Income, Return on Investment, and the individual components of these figures, given a larger set of data.

You also will need to determine how a change in a specific component of the calculation (such as income, expenses, or interest rate) will impact ROI and RI. The best way to answer a question like that is to create a simple example, change the number the question says to change, and recalculate the answer with the new information.

You must understand the key differences between Residual Income (RI) and Return on Investment (ROI): ROI is focused on the rate of the return whereas RI is focused on the absolute amount of the return. This basic difference means that the use of one or the other of these for performance measurement may cause division managers to make different decisions regarding which investments to accept or reject.

**Note:** Return on Investment (ROI) focuses on the **rate of return**, or percentage of return, while Residual Income (RI) focuses on the **absolute amount of return**.

## Balanced Scorecard

In the topic of *Strategic Planning* in Section B, we discussed how to develop a strategic plan, including stating the company's goals, formulating strategies to attain the goals, and implementing the strategies. The Balanced Scorecard is a widely-used strategic performance management tool designed to manage strategic performance. The balanced scorecard transforms an organization's strategic plan from a passive document into the "marching orders" for the organization in its day-to-day activities. It provides a framework that not only provides performance measurements but helps management to identify what needs to be done and how its achievement can be measured. The balanced scorecard enables execution of strategies.

Drs. Robert Kaplan and David Norton introduced the concept of the balanced scorecard in a Harvard Business Review article in 1992. Since then, the concept has evolved and changed rather substantially. The balanced scorecard has evolved from an initial measurement and evaluation tool to a means of managing the organization's progress toward achieving its strategic plan. The changes have been documented in a series of books published by Kaplan and Norton on the topic from 1996 through 2008. Though the changes have been beneficial to the concept, they have caused some confusion because the understanding of what a balanced scorecard is varies widely depending upon when an individual first read about the concept and whether that individual has kept up with the advancements.

The balanced scorecard initially developed as a response to problems caused by evaluating managers only on the quarterly or annual financial performance of their business units. If managers are evaluated and rewarded based on only their units' short-term financial performance, then that is what managers will primarily focus on. This focus on short-term financial performance often takes place to the detriment of other dimensions that may be equally or more important for improved long-term financial performance. For example, a focus on cost containment to improve quarterly results can result in a loss of quality due to the use of inferior parts. The long-term result of loss of quality is loss of customers and, ultimately, loss of business.

The balanced scorecard includes both financial and nonfinancial measures in evaluating the overall contribution made by each unit to the achievement of company goals. Financial measures that focus on short-term financial performance are in fact **lagging** indicators of how the company is doing.

While the balanced scorecard does use financial measurements, it also uses non-financial and operational indicators that measure the basic performance of the company and improvements it is making in those indicators. Improvements in the non-financial measures provide the prospect of increased future economic value for shareholders. Nonfinancial measures focus on performance that should ultimately result in improved long-term financial performance. Thus nonfinancial measures are **leading** indicators of performance.

The balanced scorecard encourages managers to focus on elements that tend to lead to **long-term success** instead of on short-term financial performance by rewarding them for improvements in those elements that tend to lead to long-term success. Evaluating and rewarding managers based on these non-financial indicators should lead to long-term financial performance improvements, if the proper non-financial indicators have been selected.

Each company needs to develop its own set of metrics and means to assess its progress toward meeting its goals, and both the goals and the metrics should be linked to the company's vision and strategy developed in its strategic plan. Divisional and individual goals must be congruent with the goals of the corporation and contribute toward their achievement. Thus the balanced scorecard used by each division and individual will be inextricably linked with the corporation's strategy. The balanced scorecard used by each division will probably be unique, based on that division's goals and objectives. However, the balanced-scorecard approach promotes goal congruence by encouraging everyone in the organization to work toward the same goals.

The metrics used fall into four broad categories of performance indicators, also known as **perspectives**. The perspectives are hierarchical, meaning that achievement of the objectives of each perspective supports achievement of the objectives of the perspective on the next level above it. Achievement of learning and internal business process objectives leads to achievement of customer satisfaction and financial measures objectives.

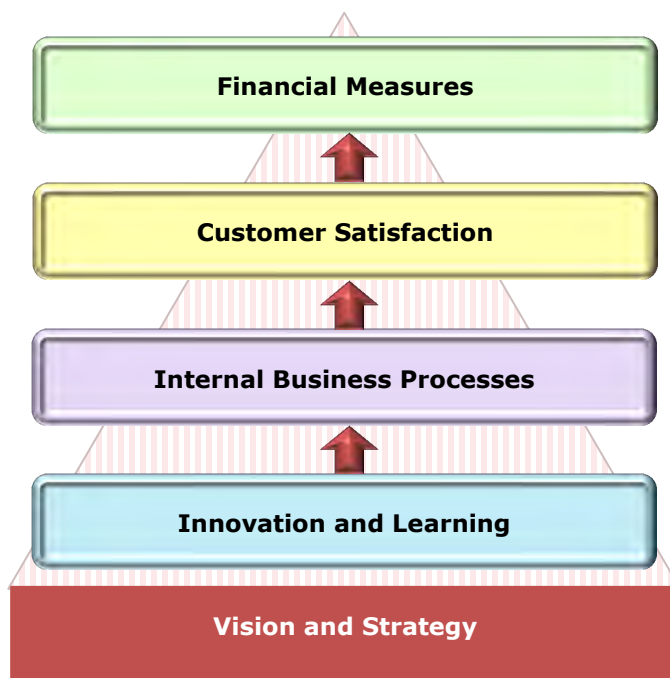
The perspectives and their content have changed since the first article written by Kaplan and Norton. The current perspectives are as follows.

### The Four Perspectives

- 1) **The Financial perspective** focuses on the organization's financial objectives and enables tracking of financial success and shareholder value. Some of the more common measures of financial performance are: operating income, revenue growth, revenue from new products, gross margin percentage, cost reductions, Residual Income, and Return on Investment. Financial performance is a priority, but good long-term financial performance will not be achieved if goals in other non-financial categories are not attained.
- 2) **The Customer perspective** involves identifying the market segment or segments the company wants to target and then measuring its success in those segments. A common method of measuring this success is the trend in the company's share of the market over time and the degree to which it increases in line with management goals. Customer satisfaction is another vital part of the customer perspective, because if customers are not satisfied they will take their business elsewhere. Customer satisfaction goals relate to the manner in which the company's management wants the company to be viewed by its customers. Management may want to become the lowest cost supplier, in which case pricing goals will be part of the customer perspective. Other management goals with respect to the customer perspective may be meeting customer needs better than the competition or being known for high quality and excellent customer service. Being the lowest cost supplier can be measured by the customer's total cost of using the company's product relative to the customer's total cost to use competitors' products. The number of repeat customers and the percentage of deliveries that are made as promised and when promised can measure the degree to which customers' needs are being met. The number of defective products returned and the level of product reliability over time can measure achievement of quality goals. Customer surveys can be used to measure the level of customer service provided after the sale.
- 3) **The Internal Process perspective** includes innovations and improvements in products and services, operations, and customer service/support needed to create value for customers, which in turn furthers the Financial perspective. If one of the company's customer goals is to be the lowest cost supplier, this goal will need to be supported operationally by maintaining efficient, low-cost production, which can be measured by metrics such as the cost of raw materials, the number of employee hours needed to manufacture a unit of product, and plant utilization. Efficient cycle times also keep costs low. If high quality is a customer satisfaction goal, the support for that objective will also be required within the internal business processes that create high quality, such as good manufacturing practices. Meeting customers' needs better than the competition is supported by innovations in products and services, which can be measured by the number of new product introductions. Technological capability for customer service personnel is necessary to provide excellent customer service, and it is also needed in manufacturing in order to produce high quality products efficiently. Internal surveys of customer service employees could be used to determine whether or not those employees have the information they need immediately available to them, or if they frequently need to put callers on hold to search for information. Percentage of manufacturing processes with advanced controls would be a way of measuring manufacturing technology.
- 4) **The Learning and Growth perspective** (originally called the innovation and learning perspective) originally focused on employee learning, but it now covers not only human capital but also organizational capital and information capital. Initially innovation was part of this perspective, but users of the balanced scorecard system discovered that innovation properly belonged in the Internal Process category.

The Learning and Growth perspective includes the capabilities that the organization must have in order to achieve its objectives in the Internal Process perspective. Currently, the components of the Learning and Growth perspective include

- a. Human capital, or the skills, talents, and knowledge of employees;
- b. Information capital, or the information systems, networks, and technology infrastructure of the company; and
- c. Organizational capital, or the company's culture, leadership, degree of teamwork, and knowledge management.



### Key Performance Indicators

It is important for the business to select only a few critical metrics that are most relevant to its specific business strategy and then to track these measures rigorously rather than using many different measurements. These critical measures are called **key performance indicators (KPIs)**. They are measures of the aspects of the company's performance that are essential to its competitive advantage and therefore its success.

Different business strategies call for different scorecards, and quality is more important than quantity in balanced scorecard measures. Management's attention should be focused on the few key measures that are the most vital for implementing the company's chosen strategies and should not be distracted by less important measures.

In a business where customer service is critical, important measurements to track include telephone wait time, the level of knowledge and empowerment of customer service personnel, and the availability to customer service personnel of needed information. For example, a company that provides 3D printing (additive manufacturing) services using 3D design files prepared and uploaded by the customer to its website needs service personnel knowledgeable enough to provide technical advice to customers in order to achieve satisfactory results; it needs adequate numbers of customer service representatives; and it must have sufficient telephone lines to keep customers' wait times to a minimum.

**Example:** A Balanced Scorecard report for a company offering 3D printing service to customers who prepare and submit their design files created using 3D design software. The company has been serving the local market, and its strategic plan calls for expansion into the online market, serving customers around the world.

Objectives	KPI	Initiatives	Target	Results
<b>Financial Perspective:</b>				
Increase sales revenue	Rate of growth	Enter online market	20% increase	25% increase
Increase job profitability	Gross margin increase	Decr. DM & DL cost	Incr. gross margin from 40% to 45%	Gross margin incr. to 41%
<b>Customer Perspective:</b>				
Increase no. of customers	% increase	Employ search engine marketing service	10% increase	20% increase
Increase no. of sales	% increase in no. of quote requests that become orders	Speed up quoting process	5% increase	10% increase
<b>Internal Process Perspective:</b>				
Increase customer's choice of materials	No. of unique materials available	Add stainless steel and titanium	Increase from 15 to 17	Stainless steel, titanium and bronze added
Reduce cost of materials	Cost per unit	Seek new suppliers	Reduce by 5%	Reduced by 2%
Improve quote turnaround time	Average time/quote	Purchase new software	Decrease from 24 hours to 12 hours	Average time 15 hours
Improve order turnaround time	Average processing time/order	Purchase new, faster 3D printers	Decrease from 48 hours to 24 hours	Average turn-around 20 hrs.
Reduce direct labor cost	Avg. DL cost as a % of order price	New equipment will need fewer operators	Decrease from 30% to 20%	Decreased to 28%
Increase size of objects that can be manufactured	Maximum size	New equipment will have larger capacity	Increase from 24 cu. in. to 48 cu.in.	Maximum size incr. to 48 cu. in.
Reduce defects	Rate of returns	Institute new quality control program	Decrease from 5% to 2%	Increased to 7%
Develop website for receiving online orders	% of total orders received online	Contract with web-site developer	Online orders 25% of all orders	Online orders 20% of all orders
<b>Learning and Growth Perspective:</b>				
Increase customer svc. personnel's knowledge of 3D design software	No. of calls referred to supervisor	Training for customer service personnel	20% fewer calls referred	15% fewer calls referred
Improve customer information available	Average time spent on calls by customer service personnel	Purchase new Customer Relationship Management software	Reduce average time by 5%	Average call time reduced by 6%
Improve customer telephone access	Average wait time to reach customer service personnel	Add 3 new telephone lines and 2 new customer svc. employees	Reduce average wait time by 3 minutes	Average wait time reduced by 4 minutes

**Financial:** The increase in sales growth was achieved. The increase in gross profit margin was not achieved, though the gross profit margin was improved slightly.

**Customer:** Both targets were achieved.

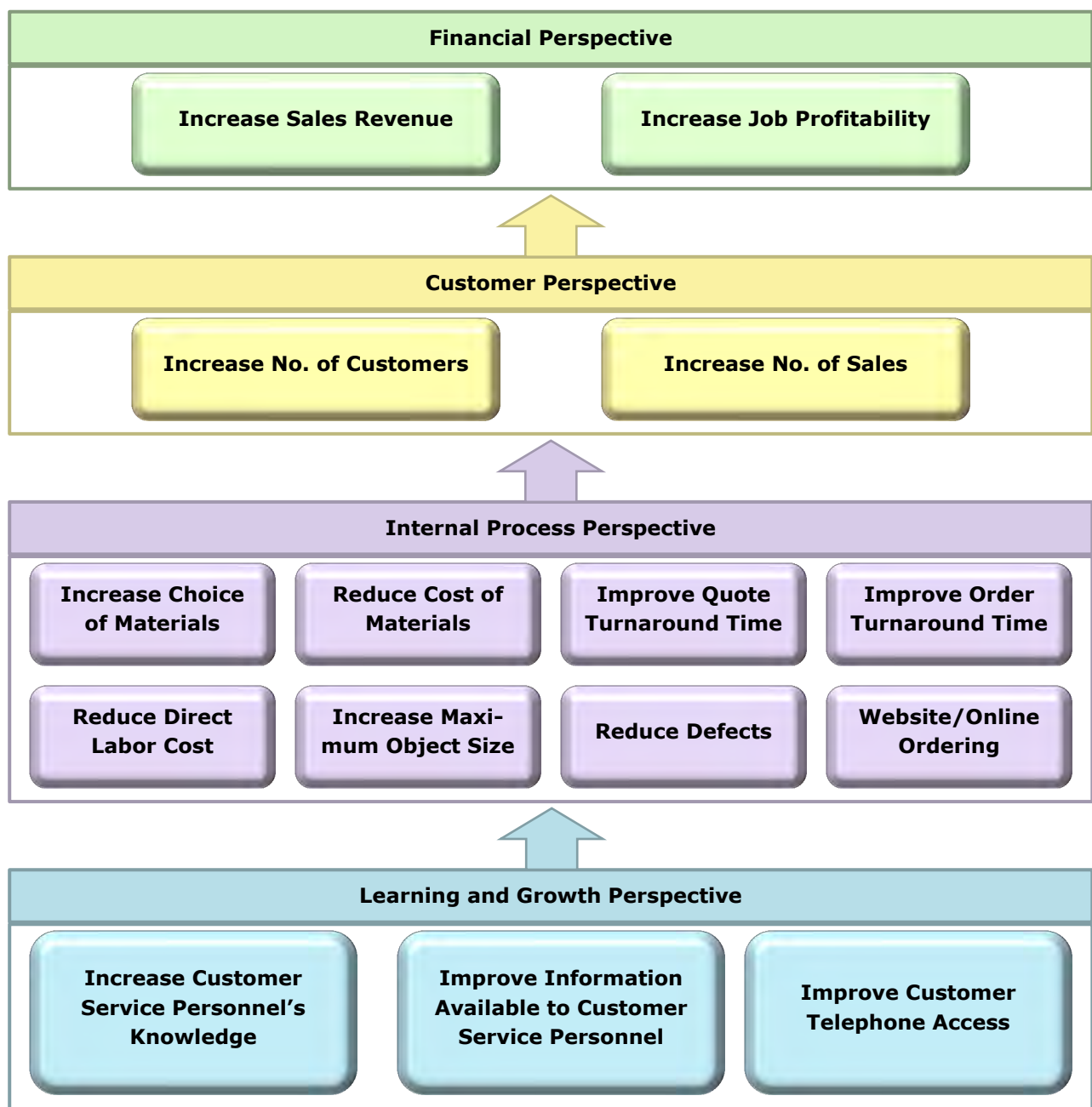
**Internal Process:** Increased choice of materials, improved order turnaround time, and increased size of manufactured objects targets were achieved. Reduction in cost of materials, improvement in quote turnaround time, reduction in direct labor cost, and percentage of online orders to total orders were improved, though the targets were not achieved. The objective of reducing defects was definitely not achieved, as the defect rate increased.

**Learning and Growth:** Reduction of average time spent on calls by customer service personnel and average wait time to reach customer service personnel targets were achieved. Reduction in number of calls referred to supervisor was not achieved, though the percentage of calls referred to a supervisor did decline.

### Strategy Map

A **strategy map** links these four balanced scorecard perspectives together, beginning with **Learning and Growth**. The goals of the **Learning and Growth** perspective contribute to the **Internal Process** perspective because the company's culture of empowering staff members and providing them with the technological support they need makes innovation and improvements in products and services possible. The innovations and improvements in products and services support the goals of the **Customer** perspective, such as increasing market share. Increased market share leads to increased profits, thereby supporting the goals of the **Financial** perspective.

When the company's financial and non-financial measures are linked in this way, the non-financial measures serve as leading indicators of the firm's future financial performance. The strategy map provides a way for all employees to see how their work is linked to the corporation's goals.



### Implementing a Balanced Scorecard

Implementation of a balanced scorecard system of performance measurement is most successful when the entire organization is aware of it and supports it. The manner in which the organization's management communicates the role, the use, and the benefits of the balanced scorecard to its employees is one of the most important factors in successful implementation of a balanced scorecard. The balanced scorecard needs to be introduced by illustrating the sequence of cause-and-effect relationships, the way the perspectives are linked, and the reasons why meeting the goals at the bottom level make it possible to meet the goals at the next level up, which in turn make the next level of goals possible, and so forth.

It is important for senior management to support the program, even as high as the board of directors. The board of directors can also have balanced scorecard goals. Having balanced scorecard goals for the board of directors creates support at the very top of the organization, and the support filters down.

**Each business unit and division should be involved in developing its own customized scorecard,** based on the company's overall objectives and the action items that the unit needs to achieve in order to contribute to those objectives. Involvement of the scorecard users builds their support. However, the scorecards as developed by middle managers need to be reviewed and approved with input from senior management to make sure they are congruent with the company's goals.

The actual scorecard report for a business unit should be organized according to the four perspectives, with each selected scorecard measure on a line and classified within its perspective. The target can be in one column followed by the actual results in the next column. Results that are in line and out of line can be identified, perhaps by color. Each manager should be accountable for specific lines on each report, and a division head is accountable for all the lines on the divisional report. A good, balanced scorecard report can also identify tradeoffs that managers might make, for instance by reducing R&D spending to achieve short-run financial goals, or making other tradeoffs that could hurt future financial performance. The decline of R&D spending or other problems would be signaled.

The balanced scorecard needs to be marketed to both management and staff to garner support. Internal promotion of the program should take place through various media, such as print, verbal, and electronic means.

- A brochure can be used to explain how the balanced scorecard will help achieve the company's long-term goals in a way that merely tracking financial performance cannot. Employee newsletters can be utilized to feature the balanced scorecard program and report on results. If improvement in market share is one of the metrics and market share in fact improves, an article can be written to highlight the factors that contributed to the positive results. On the other hand, if a metric is not met, an article can explain the reasons and outline a plan to correct the situation.
- Verbal communication can occur in regular employee meetings where management reviews the results and gives employees the opportunity to ask questions. One-on-one conversations between supervisors and employees can provide opportunities for the employees who are closest to the work to point out ways in which the program can be improved. Suggestion systems, programs inviting employee comments, and employee training programs can also be used to enlist employee support, and managers must be willing to listen to criticism and to make changes. It is essential that employees get the sense that management takes their ideas seriously, responds to them, and rewards useful ideas, because if employees feel that their input is ignored they may conclude that the program is a wasted initiative.
- General results of the balanced scorecard program can be posted on the company's intranet, with links to the overall corporate goals that each balanced scorecard result supports. In addition, the company can give senior managers password access to detailed results on the company's intranet (internal network) for their use in decision-making. Linking employees' bonuses to their goal attainment can align employee interests with the goals. Aligning compensation with balanced scorecard results maximizes the balanced scorecard's use and effectiveness.



### Balanced Scorecard Reporting

Software can be used to provide balanced scorecard performance information to interested parties. However, installing dedicated balanced scorecard software does not mean that the balanced scorecard has been implemented. Specialized software merely tracks the results of a balanced scorecard program. A business must develop its own balanced scorecard for each unit, undertake the implementation project, and follow up on the results.

### Problems With Balanced Scorecard Use for Performance Measurement

There are several problems with the balanced scorecard:

- It is difficult to use scorecards for comparisons across business units because each business unit has its individualized scorecard. Scorecard evaluation is more effective when it is used to judge the progress of an individual business unit relative to the prior year or relative to its goals rather than when used to compare a manager's performance with that of other managers or a segment's performance with that of other segments.
- In order to implement balanced scorecard performance measurement, a firm must have extensive **enterprise resource planning**<sup>56</sup> systems to capture the required information.
- Non-financial data is not subject to control or audit and thus its reliability could be questionable.
- The efficacy of the balanced scorecard in achieving the organization's strategic goals must be monitored closely. If all of the non-financial targets are achieved but the financial targets are not achieved, then probably a strong causal relationship does not exist between the non-financial indicators chosen for monitoring and the financial goals. The non-financial indicators may need to be re-evaluated and changed.
- If the balanced scorecard is used as a "command and control" document that is used to control behavior, employees may "make the numbers" but not be committed to achieving the organization's goals. Instead, the balanced scorecard should be used to create an environment in which everyone can learn and grow.

If developed and used properly, the balanced scorecard is an effective method of developing strategies and evaluating progress toward meeting goals.

Question 156: Garret Corporation has decided to implement a balanced scorecard evaluation system and is considering several measurement factors.

Customer returns  
Number of employees  
Manufacturing throughput time  
Number of manufacturing plants  
Return on investment  
Training hours

Which of the following are **most** likely non-financial factors to be used in a balanced scorecard?

- a) Customer returns, manufacturing throughput time, return on investment.
- b) Number of employees, number of manufacturing plants, training hours.
- c) Customer returns, manufacturing throughput time, training hours.
- d) Customer returns, number of employees, number of manufacturing plants.

(ICMA 2013-2)

<sup>56</sup> Enterprise resource planning (ERP) is a usually a suite of integrated business software applications that a company can use to collect, store, manage and interpret data from multiple business activities. Enterprise resource planning is covered in Section D.



### Customer and Product Profitability Analysis

The ability to evaluate the profitability to the firm of a specific customer or group of customers is important because of the 80-20 rule: 80% of profits usually come from 20% of a firm's customers. Furthermore, 20% of a firm's customers are usually completely **unprofitable**. To maintain competitive advantage, a company needs to work hard to attract profitable customers and keep them, and it needs to work equally hard to discourage the unprofitable customers from continuing to drag down profits. Profitable customers can be attracted and kept through outstanding customer service and unprofitable customers can be discouraged with fewer discounts and promotional offers.

Customer profitability analysis determines the profitability of an individual customer or a group of customers, enabling managers to coordinate their customers' costs-to-serve. A manager might want to re-price activities that cause high costs-to-serve or reduce available services for customers that are high cost-to-serve. To customers that are identified as low cost-to-serve, the manager can offer discounts in order to increase the sales volume from that group of customers. The most profitable customers can be provided with improved customer service in order to maintain their loyalty.

If a particular customer is unprofitable because of the particular products or services the customer is purchasing or using, the manager may be able to shift that customer's mix toward higher-margin products and services, thereby converting an unprofitable customer into a profitable customer.

Customer profitability information can also be used for targeted marketing. It can reveal the types of customers that the company wants to market to and the types it does not want to market to.

An example of customer profitability information is a bank generating data about the services being used by each business customer. Many banks use account analysis to determine the total fees to charge their business customers. At the end of each month or each quarter, the bank prepares an analysis report for each business customer showing the customer's average balance of loans outstanding, the interest rate being charged, and the bank's cost for the funds lent out to that customer. A large commercial customer might use cash management services such as lockbox or concentration banking, and providing those services generates costs for the bank, such as an allocated portion of the cash management operations employees' salaries and facility costs. The checking account deposits that the commercial customer keeps in the bank are available to the bank to invest in loans to other customers, thereby generating revenue. All of this information is put together into an account analysis for each customer each period, and the analysis process generates the fee that should be charged to the customer. The account analysis report goes out to the customer along with the fee invoice, and if a customer wants to decrease future fees, her or she can increase the amount of non-interest bearing deposits kept on deposit with the bank.

Product profitability analysis is just as important as customer profitability analysis. Product profitability analysis can identify products and services that are unprofitable so that those products and services can be either re-priced or discontinued and replaced with new products and services that are more profitable.

When customers and products are being evaluated for their profitability, accurate allocations of common costs are critical. Several methods of allocating common costs are covered in Section D, *Cost Management*. Activity-based costing (ABC) is particularly useful for product profitability analysis.

When making a decision about whether to drop a customer or product that appears unprofitable after allocation of common costs, though, only the operating profit at the customer level or product level should be considered. Customer-level or product-level operating profit includes only **relevant** revenues and costs. Relevant revenues and relevant costs are those expected **future** revenues and costs that **differ among alternatives**. If a cost that is being allocated to a given customer or product would continue to exist if that customer is dropped or that product is discontinued, it is not a relevant cost.

Only relevant revenues and costs need to be considered in the decision-making process because:

- It is important to focus on the future since nothing can be done to change past costs that have already been incurred (called **sunk costs**). Because decisions focus on selecting future courses of action, sunk costs are **irrelevant** to the decision process.
- We must focus only on the factors that **differ among alternatives**. Revenues and costs that are the same between options are not relevant because they will be the same no matter which option is selected.

In considering what factors to include in the decision process, we must ask ourselves, "What difference will this decision make? What will be **different** as a result of making this decision versus a different decision?"

An **avoidable cost** is a cost that can be avoided if a particular option is selected. It is a cost that would go away if sales to a particular customer stopped or if the company stopped manufacturing a product. For example, if the company discontinues a product, the variable costs to produce that product (and the revenues from its sale too, of course) will go away. Avoidable costs are relevant costs to the decision-making process because they will continue if one course of action is taken but they will not continue if another course of action is taken.

An **unavoidable cost** is an expenditure that will not be avoided (i.e., will not go away) regardless of which course of action is taken. Continuing the example from above, unavoidable costs would be costs for idle production facilities that would not be used if the product were discontinued but which the company could not dispose of.

Avoidable and unavoidable costs are relevant in a decision to drop a customer or discontinue a product. If dropping the customer or the product would avoid certain costs, those avoidable costs are relevant to the decision. Unavoidable costs, however, are irrelevant because they do not differ between the two alternatives. Using the example above, the costs for the production facilities will be the same whether the company continues producing the product or discontinues the product. Therefore, those fixed plant costs are unavoidable costs and they are not relevant to the decision.

A central administrative cost that has been allocated to a product or customer is another example of an unavoidable cost, because if that product or customer no longer exists in the future, the central administrative cost will continue to be incurred by the company. The cost would simply be allocated to other, remaining products or customers. So for the company as a whole, central administrative costs would not differ between the two alternatives and thus they are not relevant to the decision of dropping the product/customer or continuing to produce the product/sell to the customer.

Only costs that would be avoided (i.e., costs that would go away) if the product or customer is dropped are relevant to the decision of whether or not to drop the product or customer.

Question 157: Pet Toys Inc. has four customers. Details on revenues and expenses are presented below.

	<u>Customer A</u>	<u>Customer B</u>	<u>Customer C</u>	<u>Customer D</u>
Units sold	10,000	20,000	35,000	50,000
Sales	\$100,000	\$150,000	\$200,000	\$250,000
Cost of goods sold	50,000	60,000	70,000	75,000
Delivery cost	10,000	25,000	30,000	50,000
Order taking	15,000	20,000	25,000	30,000
Administration	30,000	30,000	30,000	30,000
Depreciation	20,000	20,000	20,000	20,000
Utilities	<u>10,000</u>	<u>10,000</u>	<u>10,000</u>	<u>10,000</u>
Profit / (Loss)	\$(35,000)	\$(15,000)	\$15,000	\$35,000

Which customer has the highest customer level operating profit per unit sold?

- a) Customer A.
- b) Customer B.
- c) Customer C.
- d) Customer D.

(ICMA 2013)

## Appendix A: Incremental Unit-Time Learning Model for Financial Calculators

**Note:** The following is provided for your information only. This is **not** required knowledge for the CMA exam. The process of calculating incremental unit-time learning model figures on a financial calculator would take far too much time to be required for an exam question. Furthermore, financial calculators are not required for the CMA exams. However, understanding this information may aid your understanding of the incremental unit-time learning model.

With the incremental unit-time learning model and a six-function calculator, it is possible to calculate only the amount of time that will be required to produce the **last** unit of each group of doubled units (that is, units 2, 4, 8, 16, and so forth). In order to determine the time required to produce units 3, 5, 6, 7, and 9 through 15, a financial calculator is required because the calculation is accomplished using logarithms and negative exponents.

The financial calculators permitted in the exam are:

- Texas Instruments BA II Plus (**not** the BA II Plus Professional).
- Hewlett Packard 10 B II.
- Hewlett Packard 12c.
- Hewlett Packard 12c Platinum.

The estimated times required for each lot in the Ray Lighting Manufacturing example used in the main part of this book in the topic of *Learning Curves* are explained and calculated in this appendix using the incremental unit-time learning model and a financial calculator. The Ray Lighting example will be repeated below.

### Logarithm Basics

A **logarithm** (log for short) of a number  $x$  is the exponent by which another value, called the **base**, needs to be raised in order to produce  $x$ . For example, if the base is 10, the log of 100 is 2, because  $10^2 = 100$ . Any number can be the base.

The **natural logarithm** is a special form of logarithm that always uses a base of approximately 2.718281828 ("approximately" because that figure is a rounded decimal). The natural logarithm of a number  $x$  is the exponent by which 2.718281828 needs to be raised in order to produce  $x$ . In the world of the natural logarithm, the base 2.718281828 is known as **e**. For example, the natural log of 1,500 is 7.3132, because  $2.718281828^{7.3132} = 1,500$ . "The natural log of 1,500" is written in notation as  $\ln(1,500)$ . Calculating a number with a decimalized exponent (such as 7.3132) is extremely complicated and can be done only with a financial calculator or computer.

To compute  $2.718281828^{7.3132}$  on a financial calculator, perform the following steps:

- 1) Enter [2.718281828].
- 2) Press the key marked [ $y^x$ ]. To access the [ $y^x$ ] key, you may need to use another key to shift to the secondary key usage. For example, on the TI BA II Plus calculator, the shift key is labeled "2<sup>ND</sup>." On the HP 10 B II calculator, the shift key has an orange bar along the lower half of the key.
- 3) Enter [7.3132].
- 4) Press [=].

The display (if rounded to 4 decimals) will show 1,499.9694, which rounded to the nearest integer is 1,500. (The difference is in rounding only, the result of both the base and the exponent being rounded decimals.)

To calculate the natural logarithm of a number  $x$ :

- 1) Input the number  $[x]$ , and
- 2) Press the key marked  $[\text{LN}]$  (which stands for "natural log"). To access the  $[\text{LN}]$  key, you may need to shift to the secondary key usage.

For example, calculate the natural log of 1,500 by entering 1,500 and then pressing  $[\text{LN}]$ . It is not necessary to press the equals sign. The display (rounded to 4 decimals) will show 7.3132, which is the natural logarithm of 1,500.

The natural logarithm of a number less than 1 will always be a negative number. Thus, the natural logarithm of 0.60 is  $-0.5108$  (rounded to 4 decimals). To calculate this number on a financial calculator, input  $[0.60]$  then press  $[\text{LN}]$ . The result is  $-0.5108$  (or more decimals, if the calculator is set to display more decimals).

With learning curves, we work with numbers that are less than 1 because learning curves are percentages (so 60% is 0.60 in decimal form). In the following examples we will be using the natural log of a learning curve (such as 0.60), which will be negative, to calculate an exponent, identified as "b" in the formula we will be using. This negative natural log will cause the exponent (b) that we calculate to be negative, so we will be working with negative natural logs and negative exponents.

To raise any number  $x$  to a negative power on your financial calculator,

- 1) Input  $[x]$ ,
- 2) Press the  $[y^x]$  key,
- 3) Enter the value of the exponent followed by the  $[+/-]$  key, and
- 4) Press  $[=]$ .

### Calculating the Time Required to Produce Any Unit Using a Financial Calculator and the Incremental Unit-Time Learning Model

The formula to calculate the time required to produce any unit using the Incremental Unit-Time Learning model is:

$$y = ax^b$$

- Where:
- $y$  = Time required to produce the last unit of output (that is, the unit for which the time required is desired)
  - $a$  = Time required to produce the first unit of output
  - $X$  = Cumulative number of units produced up to and including the unit for which the time required is desired
  - $b$  = An exponent, calculated as:

$$\frac{\text{Natural log of the learning \% expressed as a decimal}}{\text{Natural log of 2}}$$

$$\text{Or: } \frac{\ln(\text{learning \%})}{\ln(2)}$$

**Example:** The cost accountant for Ray Lighting Manufacturing Company is planning production costs for a new lamp. The lamp will be subject to a 60% learning curve since it involves only minimal adjustments to established processes. The accountant expects the initial lot of 500 lamps to require 1,000 hours of labor. Costs are as follows:

Direct Labor	\$20/hr.
Direct Materials	\$150/lot of 500
Variable OH Applied	\$25/DLH

**What is the time required to produce each of 8 lots using the Incremental Unit-Time Learning model, and what is the total time required for all 8 lots?**

With the Incremental Unit-Time Learning model and a 60% learning curve, each time the quantity of units produced doubles, the time required to produce the **last** unit is 60% of the time that was required to produce the **last** unit of the previous production level (before it doubled). In this example, of course, we are working with lots of 500 units rather than with single units.

The first lot takes 1,000 hours. Lot 2 requires  $1,000 \times 0.60$ , or 600 hours; lot 4 requires  $600 \times 0.60$ , or 360 hours; and lot 8 requires  $360 \times 0.60$ , or 216 hours. We can calculate these values using a 6-function calculator, but with a 6-function calculator we can calculate only the time it takes to produce lots 1, 2, 4 and 8. With just a 6-function calculator, we cannot calculate the amount of time required to complete the other lots (that is, lots 3, 5, 6 and 7), and thus we cannot calculate the time required to produce all 8 lots.

The time that each lot requires will decline with **every** lot produced, and therefore the time required for lot 3, for example, will be somewhere in between 600 hours (the time for lot 2) and 360 hours (the time for lot 4).

The formula is:

$$y = ax^b$$

Where:  $y$  = Time required to produce the last unit or lot of output (that is, the unit or lot for which the time required is desired)

$a$  = Time required to produce the first unit or lot of output

$X$  = Cumulative number of units or lots produced (up to and including the unit/lot for which the time required is desired)

$b$  = An exponent, calculated as:

$$\frac{\ln(\text{learning \%})}{\ln(2)}$$

The above formula can be used to calculate the time required for **all 8 lots**, so you will be able to check the results for lots 2, 4 and 8 against the times calculated above for them.

The calculated exponent ( $b$ ) will be the same for every lot in a given scenario because the learning percentage is the same for every lot and the denominator is always  $\ln(2)$ , so we will calculate  $b$  first.

To calculate the natural log of 0.60, input [.60] on your financial calculator and press [LN]. The display will show  $-0.5108$ . To calculate the natural log of 2, input [2] on your financial calculator and press [LN]. The display will show  $0.6931$ . Therefore,  $b = -0.5108 \div 0.6931$ , which equals  $-0.7370$  or  $-0.737$ .

The time required to produce lot 2 ( $y_2$ ) is 600 hours, calculated as follows:

$$y = ax^b$$

$$y_2 = 1,000 \times 2^{-0.737}$$

Since there are no brackets around  $1,000 \times 2$  in the above formula, we will be raising only the 2 (not 2,000) to the  $-0.737$  power. After raising 2 to the  $-0.737$  power, we multiply the result by 1,000.

(Continued)

To calculate  $2^{-0.737}$ , input [2], press the [ $y^x$ ] key, input [.737] followed by the [ $+/-$ ] key, and then press the [=] key. Multiply the result by 1,000.

$$\begin{aligned} y_2 &= 1,000 \times 2^{-0.737} \\ 2^{-0.737} &= 0.60 \\ y_2 &= 1,000 \times 0.60 \\ y_2 &= \underline{600} \end{aligned}$$

Note that 600 is the same answer that we calculated for lot 2 by multiplying 1,000 by 0.60 (that is,  $1,000 \times 0.60 = 600$ ).

The time required to produce lot 3 ( $y_3$ ) is 445 hours, as follows:

$$\begin{aligned} y_3 &= 1,000 \times 3^{-0.737} \\ 3^{-0.737} &= 0.445 \\ y_3 &= 1,000 \times 0.445 \\ y_3 &= \underline{445} \end{aligned}$$

The time required to produce the lot 4 ( $y_4$ ) is 360 hours, as follows:

$$\begin{aligned} y_4 &= 1,000 \times 4^{-0.737} \\ 4^{-0.737} &= 0.360 \\ y_4 &= 1,000 \times 0.360 \\ y_4 &= \underline{360} \end{aligned}$$

Note that 360 is the same answer that we calculated for lot 4 by multiplying 1,000 by 0.60 twice (that is,  $1,000 \times 0.60 \times 0.60 = 360$ ).

The time required to produce lot 5 ( $y_5$ ) is 305.4 hours, as follows:

$$\begin{aligned} y_5 &= 1,000 \times 5^{-0.737} \\ 5^{-0.737} &= 0.3054 \\ y_5 &= 1,000 \times 0.3054 \\ y_5 &= \underline{305.4} \end{aligned}$$

The time required to produce lot 6 ( $y_6$ ) is 267 hours, as follows:

$$\begin{aligned} y_6 &= 1,000 \times 6^{-0.737} \\ 6^{-0.737} &= 0.267 \\ y_6 &= 1,000 \times 0.267 \\ y_6 &= \underline{267} \end{aligned}$$

The time required to produce lot 7 ( $y_7$ ) is 238.3 hours, as follows:

$$\begin{aligned} y_7 &= 1,000 \times 7^{-0.737} \\ 7^{-0.737} &= 0.2383 \\ y_7 &= 1,000 \times 0.2383 \\ y_7 &= \underline{238.3} \end{aligned}$$

(Continued)

The time required to produce lot 8 ( $y_8$ ) is 216 hours, as follows:

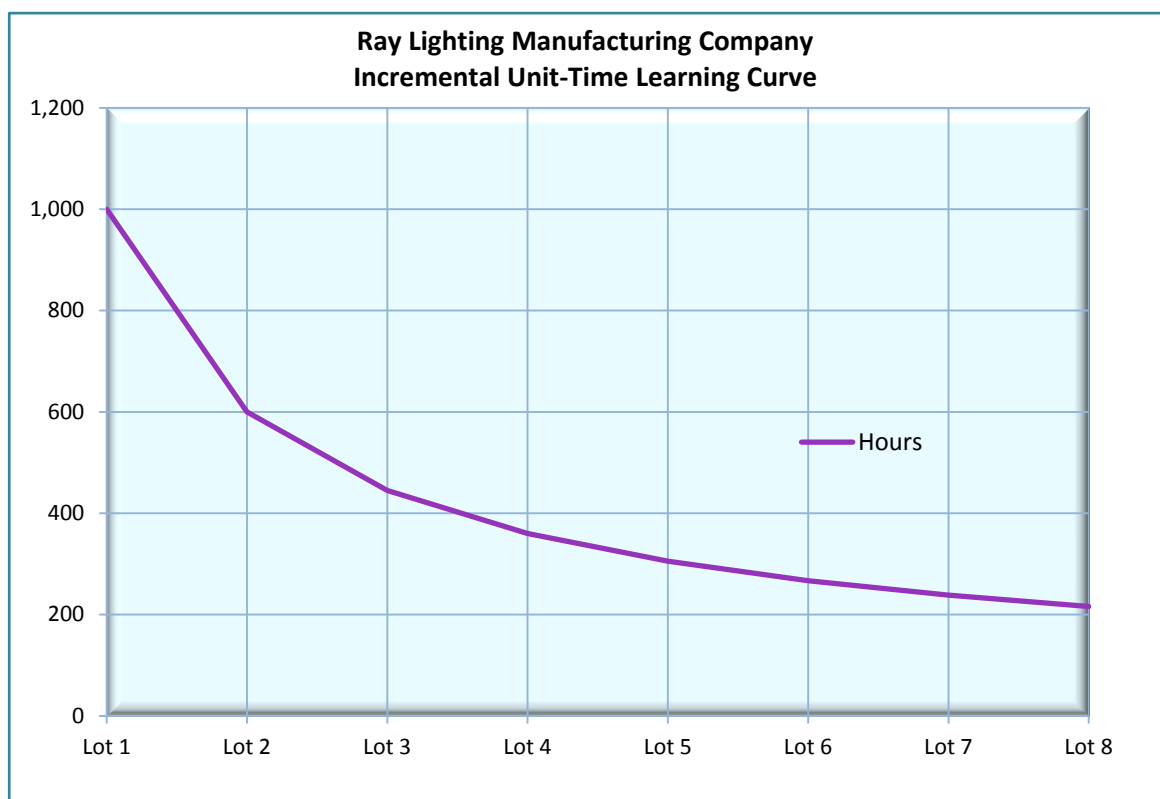
$$\begin{aligned}
 y_8 &= 1,000 \times 8^{-0.737} \\
 8^{-0.737} &= 0.216 \\
 y_8 &= 1,000 \times 0.216 \\
 y_8 &= \underline{216}
 \end{aligned}$$

Note that 216 is the same answer we calculated for lot 8 by multiplying 1,000 by 0.60 three times (that is,  $1,000 \times 0.60 \times 0.60 \times 0.60 = 216$ ).

Therefore, the total time required to produce all 8 lots is:

$$1,000 + 600 + 445 + 360 + 305.4 + 267 + 238.3 + 216 = 3,431.7 \text{ or } \underline{3,432} \text{ hours.}$$

Below is a graphical representation of the Ray Lighting learning curve using the times calculated with the incremental unit-time learning model and a financial calculator. A learning curve is an example of a **nonlinear cost function**, which graphs as a curved line.





## Appendix B: Variance Report for a Company Selling Two Products

With Detail by Product for Revenue, Variable Cost and Contribution Margin

	<u>Col. 1</u>	<u>Col. 2</u> (2)=(1)-(3)	<u>Col. 3</u>	<u>Col. 4</u> (4)=(3)-(5)	<u>Col. 5</u>	<u>Col. 6</u> (6)=(1)-(5) also (6)=(2)+(4) Static Budget Variances
	<u>Actual Results</u>	<u>Flexible Budget Variances</u>	<u>Flexible Budget</u>	<u>Sales Volume Variances</u>	<u>Static Budget</u>	<u>Static Budget Variances</u>
Units sold	20,000	0	20,000	4,000– U	24,000	4,000– U
Revenues	\$2,500,000	\$125,000+ F	\$2,375,000	\$505,000– U	\$2,880,000	\$380,000– U
Variable costs	<u>1,900,200</u>	<u>160,200+ U</u>	<u>1,740,000</u>	<u>372,000– F</u>	<u>2,112,000</u>	<u>211,800– F</u>
Contrib. margin	\$ 599,800	\$ 35,200– U	\$ 635,000	\$133,000– U	\$ 768,000	\$168,200– U
Fixed costs	<u>570,000</u>	<u>18,000+ U</u>	<u>552,000</u>	<u>0</u>	<u>552,000</u>	<u>18,000+ U</u>
Oper. income	<u>\$ 29,800</u>	<u>\$ 53,200– U</u>	<u>\$ 83,000</u>	<u>\$133,000– U</u>	<u>\$ 216,000</u>	<u>\$186,200– U</u>
		<b>\$53,200 U</b>		<b>\$133,000 U</b>		
		<b>Total flexible budget variance</b>		<b>Total sales volume variance</b>		
		<b>\$186,200 U</b>				
		<b>Total static budget variance</b>				

**Detail Schedule for revenue line on variance report for a company selling two products:**

	Revenue Per Unit (Sales Price)	# Units Sold	Total Revenue	Weighted Avg. Price Per Unit (Tot Rev/Tot Units)
<b><u>Actual Results</u></b>				
Total Revenue:	AP	AQ		
Product A	\$122.00	12,500	\$ 1,525,000	
Product B	130.00	<u>7,500</u>	<u>975,000</u>	
		20,000	<b>\$2,500,000</b>	\$125.00
			(Rev. line, col. 1 on Variance Rpt.)	
<b><u>Flexible Budget (budgeted sales prices per unit, actual # sales)</u></b>				
Total Revenue:	SP	AQ		
Product A	\$115.00	12,500	\$ 1,437,500	
Product B	125.00	<u>7,500</u>	<u>937,500</u>	
		20,000	<b>\$2,375,000</b>	\$118.75
			(Rev. line, col. 3 on Variance Rpt.)	
<b><u>Static Budget</u></b>				
Total Revenue:	SP	SQ		
Product A	\$115.00	12,000	\$ 1,380,000	
Product B	125.00	<u>12,000</u>	<u>1,500,000</u>	
		24,000	<b>\$2,880,000</b>	\$120.00
			(Rev. line, col. 5 on Variance Rpt.)	

**Detail Schedule for variable cost line on variance report for a company selling two products:**

	<b><u>Variable Cost Per Unit</u></b>	<b><u># Units</u></b>	<b><u>Total Variable Cost</u></b>	<b><u>Weighted Avg. Cost Per Unit (Tot Cost/Tot Units)</u></b>
<b><u>Actual Results</u></b>				
Total Variable Cost:	<b>AP</b>	<b>AQ</b>		
Product A	\$93.00	12,500	\$ 1,162,500	
Product B	98.36	<u>7,500</u>	<u>737,700</u>	
		20,000	<b>\$1,900,200</b>	\$95.01
			<i>(Variable Cost line, column 1 on Variance Report)</i>	

**Flexible Budget (budgeted sales prices per unit, actual # sales)**

Total Variable cost:	<b>SP</b>	<b>AQ</b>		
Product A	\$84.00	12,500	\$ 1,050,000	
Product B	92.00	<u>7,500</u>	<u>690,000</u>	
		20,000	<b>\$1,740,000</b>	\$87.00
			<i>(Variable Cost line, column 3 on Variance Report)</i>	

**Static Budget**

Total Variable Cost:	<b>SP</b>	<b>SQ</b>		
Product A	\$84.00	12,000	\$ 1,008,000	
Product B	92.00	<u>12,000</u>	<u>1,104,000</u>	
		24,000	<b>\$2,112,000</b>	\$88.00
			<i>(Variable Cost line, column 5 on Variance Report)</i>	

**Detail Schedule for contribution margin line on variance report for a company selling two products:**

	<u>CM Per Unit</u>	<u># Units</u>	<u>Total CM</u>	<u>Weighted Avg. CM Per Unit (Tot CM/Tot Units)</u>
<b><u>Actual Results</u></b>				
Contrib. Margin:	<b>AP</b>	<b>AQ</b>		
Product A	\$29.00	12,500	\$ 362,500	
Product B	31.64	<u>7,500</u>	<u>237,300</u>	
		20,000	<b>\$599,800</b>	\$29.99
			<i>(Contrib. Margin line, column 1 on Variance Report)</i>	

**Flexible Budget (budgeted sales prices per unit, actual # sales)**

Contrib. Margin:	<b>SP</b>	<b>AQ</b>		
Product A	\$31.00	12,500	\$ 387,500	
Product B	33.00	<u>7,500</u>	<u>247,500</u>	
		20,000	<b>\$635,000</b>	\$31.75
			<i>(Contrib. Margin line, column 3 on Variance Report)</i>	

**Static Budget**

Contrib. Margin:	<b>SP</b>	<b>SQ</b>		
Product A	\$31.00	12,000	\$ 372,000	
Product B	33.00	<u>12,000</u>	<u>396,000</u>	
		24,000	<b>\$768,000</b>	\$32.00
			<i>(Contrib. Margin line, column 5 on Variance Report)</i>	

## Answers to Questions

**1 b** – Current liabilities are those liabilities that will be settled within one year or during the operating cycle if it is longer than one year. Long-term debt that matures within one year and will be retired through the use of current assets is a current liability.

**2 d** – A statement of financial position (balance sheet) cannot provide a basis for determining profitability and assessing past performance for a specific period. An income statement is required for that.

**3 a** – The income statement reports the results of operations for a period of time.

**4 d** – Dividends paid to company shareholders are shown on the Statement of Cash Flows as cash flows from financing activities.

**5 a** – The direct method of calculating net cash provided or used by operating activities shows the major classes of operating cash receipts such as receipts from customers less the major classes of operating cash disbursements such as cash paid for merchandise. This is different from the indirect method, because the indirect method begins with net income and adjusts it to include net changes in operating cash that do not appear on the income statement and to remove noncash items that are included in the income statement.

**6 b** – The indirect method of calculating and reporting a company's net cash flow from operating activities on its statement of cash flows is the method most commonly used.

**7 d** – The correct order of presentation in the Statement of Cash Flows is: (1) Cash Flows from Operating Activities, (2) Cash Flows from Investing Activities, and (3) Cash Flows from Financing Activities. This is the order of presentation whether the direct or the indirect method is being used.

**8 c** – Net cash flow from operating activities is:

Net income	\$ 920,000
Plus: Depreciation expense	110,000
Plus: Increase in accounts payable	45,000
Minus: Increase in accounts receivable	(73,000)
Plus: Increase in deferred income tax liability	16,000
	<u>\$1,018,000</u>

**9 d** – The cash received from the sale of the stock was \$150,000, and that is the amount that should be shown in the Investing Activities section of James' Statement of Cash Flows for the transaction.

**10 c** – Gains and losses need to be eliminated from net income in the indirect method, so the gain needs to be deducted from net income.

**11 a** – This question requires us to identify which items in this list are investing and which are financing activities. There are two of each. The investing activities are: 1) payment for the purchase of machinery (–\$1,000,000), and 2) the sale of a plant building (+\$2,400,000). These give a net cash flow from investing activities of \$1,400,000. The two financing activities are: 1) issuing stock (+\$8,000,000), and 2) dividends paid on the stock (–\$800,000). These give a net cash flow from financing activities of \$7,200,000.

**12 d** – Amortization (as well as depreciation) is always added back to net income in the indirect method.

**13 a** – Net cash flow from operating activities is:

Net income	\$2,000,000
Minus: Increase in accounts receivable	(300,000)
Plus: Decrease in inventory	100,000
Plus: Increase in accounts payable	200,000
Plus: Depreciation expense	400,000
Minus: Gain on the sale of available-for-sale securities	(700,000)
	<u>\$1,700,000</u>

**14 c** – First we need to find how much cash dividends were declared for the year, then we can find how much cash dividends were actually paid during the year. The retained earnings account began the year with a balance of \$100,000 and ended the year with a balance of \$125,000. Net income for the year increased retained earnings by \$40,000 to \$140,000. The stock dividend in the amount of \$8,000 was almost certainly a small stock dividend, so the full \$8,000 was debited to retained earnings, reducing it to \$132,000. The only other transaction(s) that would have affected retained earnings would have been the declaration of cash dividends, which reduce retained earnings. Thus, dividends declared must have been \$7,000 (\$132,000 – \$125,000 ending balance). The question tells us that dividends payable decreased by \$5,000 during the year. That means that \$5,000 in dividends declared during the previous year were paid during the current year and that the full \$7,000 of dividends declared during the current year were also paid during the current year. So the total cash dividends paid during the year were \$5,000 declared during the previous year + \$7,000 declared during the current year, which equals \$12,000.

**15 d** – The transactions should be disclosed in the statement of cash flows as a noncash financing activity and a noncash investing activity. When real estate is purchased with borrowed funds, the borrower/buyer signs the mortgage documents and the payment for the real estate is sent directly to the seller of the real estate by the lender. Thus the company acquired land, an investing activity, without any cash payment; and it became liable for a mortgage, a financing activity, without receiving any cash. Since the company did not pay or receive any cash, the two activities will not be included in the line items on the statement of cash flows. However, they must be disclosed as noncash financing and investing activities.

**16 c** – In order to calculate the operating activities under the indirect method, we must adjust net income for noncash and non-operating items. In this question net income is \$3,000,000. The adjustments that we need to make are: 1) add back \$1,500,000 of depreciation expense (noncash); 2) subtract \$200,000 gain from sale of land (investing activity); and 3) add back the \$300,000 increase in accounts payable (noncash expense). The dividends paid are not an adjustment to net income because dividends are an after income item and not included in the calculation of net income. The answer is \$4,600,000.

**17 c** – Cash and cash equivalents include all cash items and short-term investments with a maturity of 3 months or less when acquired. In this question the cash in the checking account (\$50,000), the cash in the money market account (\$100,000), and the Treasury bond purchased on November 15, 20X0 with a maturity date of January 31, 20X1 (\$300,000) are cash or cash equivalents, for a total of \$450,000. The Treasury bill purchased November 1, 20X0 with a maturity date of February 28, 20X1 is a short-term investment, but it is not a cash equivalent, because its original maturity when purchased by Senger was in 4 months.

**18 d** – Because the Treasury bond was a highly liquid investment with a maturity of three months or less when it was purchased on November 15, 20X0, it is a cash equivalent. The purchase (and sale) of a cash equivalent is not reflected on the statement of cash flows as either a cash inflow or a cash outflow. However, its balance will be included in the ending balance of cash and cash equivalents on the statement of cash flows.

**19 c** – Cash provided by operating activities is:

Net income	\$456,900
+ Depreciation	45,600
+ Decrease in accounts receivable	11,560
– Decrease in accounts payable	(2,155)
– Increase in inventory	<u>(7,620)</u>
Net cash provided by operating activities	<u>\$504,285</u>

**20 d** – Comprehensive income includes the results of all transactions except for those that are carried out with owners, such as investments by owners and the sale of new shares and distribution of dividends. It includes all changes in equity (net assets) of an entity during a period from transactions and other events and circumstances except those resulting from investments by owners and distributions to owners.

**21 d** – Writing off an account when the allowance method is used has no effect on either the income statement or on current assets. The entries to write off the account are a credit to accounts receivable and a debit to the allowance account, so the net effect on net accounts receivable and on total current assets is zero. Furthermore, the writeoff does not affect any income statement account at all. An income statement account (Bad Debt Expense) is debited when the allowance is booked, not when an account is written off.

**22 b** – In order to determine the bad debt expense for the period using the percentage of receivables method, the first thing we must do is calculate the required ending balance in the allowance account. Using the aging schedule for the calculation of the ending balance in the allowance account requires us to make four calculations, one for each of the different “ages” of receivables. By multiplying the amount in each category by the percentage estimated to be uncollectible and summing the results, we can calculate the required ending balance in the allowance account, as follows:  $(\$730,000 \times 0.01) + (\$40,000 \times 0.06) + (\$18,000 \times 0.09) + (\$72,000 \times 0.25) = \$29,320$ . \$29,320 is the amount that **should** be in the allowance account at the end of the year as a credit balance. Since the account presently has a debit balance of \$14,000, a credit of \$43,320  $(\$29,320 + \$14,000)$  will be needed in order to change the balance to a credit balance of \$29,320. The corresponding debit will be to bad debt expense.

**23 a** – A lot of unnecessary information is given in this problem. Davis Corporation uses the percentage of sales method to determine bad debt expense. Therefore, the entry to record bad debt expense is simply the percentage of current sales determined to be appropriate for bad debt expense, and that is 3%. Credit sales during the year totaled \$10,000,000, and 3% of \$10,000,000 is \$300,000.

**24 a, percentage of sales method: Ending balance in allowance account (\$1,550), bad debt expense \$1,800.** Bad debt expense is calculated as  $\$60,000 \text{ credit sales} \times 0.03 = \$1,800$ . The ending balance in the allowance account after the bad debt expense for the year is recorded is calculated as  $(\$750) + 1,000 \text{ written off} + (\$1,800) \text{ bad debt expense} = (\$1,550)$ .

**b, percentage of receivables method: Ending balance in allowance account (\$840), bad debt expense \$1,090.** Ending accounts receivable before the bad debt expense for the year is recorded is  $\$10,000 + \$60,000 \text{ credit sales} - \$55,000 \text{ collections on credit sales} - \$1,000 \text{ written off} = \$14,000$ . Since 6% of ending accounts receivable are deemed uncollectible, the ending balance in the allowance account needs to be  $\$14,000 \times 0.06$ , which equals (\$840), a credit balance. The balance in the allowance account before the bad debt expense for the year is recorded is  $(\$750) + \$1,000 \text{ written off} = \$250$ , a debit balance. The balance in the allowance account needs to be a credit balance of \$840. Therefore, the credit to the allowance account needs to be a credit of  $\$250 + \$840$ , or \$1,090. The bad debt expense is the other side of the entry, or a debit to bad debt expense of \$1,090.

**25 c** – Because the receivables were sold without recourse, the receivables need to be completely written off the books. This is done with a credit to accounts receivable for \$150,000. (The \$7,500 finance charge is the factor's fee, not interest expense.)

**26 c** – The reserve and the factor's fee will be deducted from the face amount of the receivable to calculate the amount accruing to the company before the interest charge. The reserve is 8% or \$8,800 and the factor's fee is 1.5% or \$1,650, leaving an amount accruing to the firm of \$99,550. Interest of 16% per annum for 2 months is withheld from that amount, calculated as  $\$99,550 \times 0.16 \div 360 \times 60 = \$2,655$ . This interest is withheld, reducing the amount of cash received to \$96,895.

**27 a** – When the last-in, first-out inventory cost flow assumption is being used, the most recently-purchased inventory items will be assumed to be the first ones sold. Thus, the most recently incurred costs will be allocated to cost of goods sold while the earliest costs are allocated to ending inventory.

**28 c** – In a period of rising prices, the last-in, first-out cost flow assumption usually provides the best matching of expenses against revenues because the cost allocated to sold units is the most recently incurred cost for each item of inventory.

**29 c** – If more inventory is purchased at the end of the year when prices are rising and the last-in, first-out inventory cost flow assumption is being used, the cost of the sales that take place at year-end will be increased. The increase in cost of sales will result in a decrease in net income.

**30 b** – In periods of rising costs, the last-in, first-out cost flow assumption will result in higher cost of sales because the cost of the most recently purchased inventory items will be used as the cost of the goods sold.

**31 b** – The first-in, first-out method will yield the same ending inventory value and cost of goods sold whether a perpetual or a periodic system is used because under FIFO, the oldest unit is the unit sold. Regardless of whether the company determines the oldest unit at the end of the year or after each sale, the oldest unit is always the oldest unit.

**32 d** – Net income next year will be understated because net income this year will be overstated. Income this year will be overstated because cost of goods sold this year will be understated.

The formula for cost of goods sold is:

$$\begin{array}{rcl}
 & \text{Beginning inventory} & \\
 + & \text{Purchases} & \\
 = & \text{Cost of goods available for sale} & \\
 - & \text{Ending inventory} & \\
 = & \text{Cost of goods sold} &
 \end{array}$$

If ending inventory is overstated at the end of this year, cost of goods sold will be understated for this year. Because ending inventory is overstated at the end of this year, beginning inventory for next year will also be overstated. The result will be that cost of goods sold will be overstated next year, and so net income next year will be understated.

**33 b** – Because of the way cost of goods sold is calculated (see answer to previous question), if ending inventory is overstated, cost of goods sold will be understated. If cost of goods sold is understated, net income will be overstated.

**34 d** – In these four questions a total of 800 units is available for sale (beginning inventory + purchases) and in total 570 units were sold. Therefore, 230 units are in ending inventory. Under FIFO the ending inventory is made up of the newest items of inventory. This means that the ending inventory is made up of 230 of the units purchased on November 22 for \$4.80 per unit. Therefore, ending inventory is equal to \$1,104 ( $230 \times \$4.80$ ).

**35 a** – In order to determine the gross profit we need to calculate both revenue and COGS. Revenue is fairly simple as it is  $570 \text{ units} \times \$7 \text{ selling price}$ , or \$3,990. The calculation of COGS under the weighted average method requires that we determine the average cost per unit in inventory during the month. The average cost per unit is calculated by first calculating the total cost of the inventory available for sale as follows:  $[(150 \times$



$\$4.00) + (200 \times \$4.20) + (200 \times \$4.40) + (250 \times \$4.80)]$ . We get a total cost of all inventory available for sale of \$3,520. This total cost is then divided by the total number of units available for sale (800) to get the average cost per unit of \$4.40. To calculate COGS we need to multiply the number of units sold by the average cost ( $\$4.40 \times 570 = \$2,508$ ). Now that we have both revenue and COGS we can calculate the gross profit as \$1,482 ( $\$3,990 - \$2,508$ ).

**36 d** – We already know that 570 units were sold during the period and since we are using LIFO in this question, the units sold will be the units that were most recently purchased. Therefore, COGS will be equal to \$2,584  $[(250 \times \$4.80) + (200 \times \$4.40) + (120 \times \$4.20)]$ .

**37 c** – Since this is the LIFO perpetual method, this question will be a little more difficult to track, but conceptually it is the same. For each individual sale we need to determine what the most recently purchased items in inventory were and then these units will be sold. The sale on November 5 sold 100 of the units that were in beginning inventory, reducing beginning inventory to 50 units. The sale on November 9 sold 150 of the units that had been purchased on November 7, leaving 50 of these units. The sale of 220 units on November 17 sold all of the units that had been purchased on November 11 as well as 20 of the units that had been purchased on November 7, reducing the November 7 inventory to only 30 units. The sale of 100 units on November 29 was a sale of units purchased on November 22, reducing this purchase to 150 units. So, at the end of the month, ending inventory is made up of 50 units from beginning inventory (at \$4.00 each), 30 units from the November 7 purchase (at \$4.20 each) and 150 units from the November 22 purchase (at \$4.80 each). If we do this math we get an ending inventory of \$1,046. This is also the correct number of units as we have 230 units in our ending inventory.

**38 a** – This is actually two questions in one. Not only is it a basic depreciation question, but it also tests if you know what cost to use for an asset that is purchased on an installment basis. The asset should be recorded at the cash price cost, which in this problem is \$110,000. (The additional amount paid over time is interest expense on the financing for the asset.) Since straight-line depreciation is being used, we need to subtract the salvage value from the cost to get the depreciable amount. With a salvage value of \$5,000 the depreciable amount is \$105,000. \$105,000 is then divided by the estimated useful life of 10 years to determine the depreciation expense per year of \$10,500.

**39 b** – This is a double declining balance depreciation question in which we need to calculate the depreciation expense for Year 2. Since double declining balance is being used, we will need to calculate the depreciation expense for the first year (20X8) before we can calculate the depreciation for the second year (20X9). Double declining balance depreciation expense is calculated as twice the straight-line percentage multiplied by the book balance at the beginning of the year. Because the useful life is 10 years, we would take 10% of the amount each year under straight-line. As this is double declining balance we will use 20% of the beginning book value to calculate the depreciation expense. In 20X8, depreciation expense is \$96,000 ( $\$480,000 \times 20\%$ ). This will mean that at the beginning of 20X9, the book value will be \$384,000 ( $\$480,000 - \$96,000$ ). \$384,000 is multiplied by 20% to get 20X9 depreciation expense of \$76,800.

Note that in this question the salvage value is given. The salvage value is not needed for double declining balance until the very end of its useful life when we need to make sure that we do not depreciate the asset below its salvage value.

**40** \$0 and \$1,000 – To determine if a fixed asset has been impaired, we compare the book value with the cash value of future cash flows. In question a) the future cash flows are greater than the book value of the asset so it is not impaired and no impairment loss needs to be recognized. In question b), however, the asset is impaired since the future cash flows are less than the book value. In this case the asset needs to be written down from its book value (\$4,500) to its fair value (\$3,500), or a \$1,000 impairment loss.

**41 d** – The calculation of warranty expense is simply the total value of the sales multiplied by the estimated future warranty costs at 4% of sales for the warranty period:  $\$3,000,000 \times 4\% = \$120,000$ .

**42 b** – Estimated liabilities for warranties are recognized in financial income as sales take place. The liabilities are an expense for financial reporting purposes but are not deductible for tax reporting purposes until the expense to fulfill the warranties is actually incurred.

**43 c** – HomeTheater reported the \$20,000 as income on its 20X8 tax return and paid tax on it. In 20X9, HomeTheater will include that amount in its revenue for the installation but HomeTheater will not pay income tax on the \$20,000 in 20X9 because the company already paid the tax on it in 20X8. The enacted tax rate for 20X9 is 38%. HomeTheater's deferred tax asset is 38% of \$20,000, or \$7,600.

**44 b** – We need to determine the deferred tax position as of December 31, 20X2. In order to calculate the deferred tax portion of the question, we need to multiply all future tax differences related to these fixed assets by the tax rate for each future period. As such we get the following table:

	Difference $\times$ Tax Rate	Deferred Tax Amount
20X3	$\$(9,600) \times 0.30$	$\$(2,880)$



20X4	$\$640 \times 0.35$	224
20X5	$\$6,784 \times 0.35$	2,374
20X6	$\$6,784 \times 0.35$	2,374
20X7	$\$3,392 \times 0.35$	<u>1,187</u>
<b>Total</b>		<b>\$3,279</b>

To calculate the currently payable taxes, we must determine taxable income. The book income for 20X2 was \$38,000. However, we also know that the amount of depreciation for book purposes was \$8,000 less than the depreciation for tax purposes. This means that taxable income was only \$30,000. With a 30% tax rate, the tax payable is \$8,400.

**45 a** – When a stock dividend is declared but not immediately paid, this future stock dividend is not recorded as a dividend payable but rather as “Common Shares – Issuable as a Dividend.” As such, when the dividend is declared, no liability is recorded.

**46 a** – This question is easy after we get to a certain point. If we take total income since incorporation of \$840,000 and subtract the cash dividend of \$260,000 and the small stock dividend \$60,000, we get a balance of \$520,000. We also know that retained earnings can be increased only by the transfer of net income in the year-end close. Of the choices b, c and d, all are greater than \$520,000. Therefore, we can select choice a without needing to worry about how the last item given is treated.

**47 b** – The four items reported in accumulated other comprehensive income are: (1) foreign currency translation adjustments, (2) gains or losses and prior service costs or credits related to a defined benefit pension plan that have not been recognized as components of net periodic benefit cost, (3) unrealized holding gains or losses on available-for-sale securities, and (4) the effective portion of the gain or loss on a derivative designated as a cash flow hedge. Foreign currency remeasurement gains and losses are reported on the income statement.

**48 b** – As of the end of Year 2, estimated profit on the contract was \$180,000 (\$700,000 contract price minus [\$390,000 cumulative costs incurred to date + \$130,000 costs to complete]). The project was 75% complete ( $\$390,000 \div [\$390,000 + \$130,000]$ ). Therefore, the total gross profit that should be recognized to date through Year 2 is 75% of \$180,000, or \$135,000. \$65,000 in gross profit was recognized in Year 1, so the amount of gross profit to be recognized in Year 2 is \$135,000 – \$65,000, or \$70,000.

**49 c** – This question and the following two use the standard percentage-of-completion formula. This formula is:

**(Percentage Complete × Expected Profit) – Previously Recognized Profit = Profit to Recognize**

In 20X0, \$400,000 of costs had been incurred of an estimated \$1,200,000 in total costs. Therefore, the project is 1/3 complete. So 1/3 of the expected profit of \$300,000 (\$1,500,000 – \$1,200,000) is recognized. This is \$100,000.

**50 a** – In 20X1, the project is 6/13 ( $\$600,000 \div \$1,300,000$ ) complete. At this point, the total amount of profit that should be recognized to date on the contract is \$92,308:  $([\$1,500,000 - \$1,300,000] \times 6/13)$ . However, we have already recognized \$100,000 of profit. So, using the last part of the formula, we subtract the \$100,000 that was recognized in 20X0 from the total amount of profit that should be recognized to date, and the result is a loss for 20X1.  $\$92,308 - \$100,000 = \$(7,692)$ . This is not a loss on the whole contract, at least not yet, but rather the derecognition of some of the profit that had been over recognized in prior periods.

**51 a** – In 20X2, something happened to the project and it went from an expected profit to an expected loss of \$50,000 ( $\$1,500,000 - \$1,550,000$ ). We can still use the formula but need to remember that losses are always 100% complete. This means that a total of a \$50,000 loss needs to have been recognized by the end of 20X2. However, the company already recognized \$92,308 of profit to date, so in order to change that to a loss of \$50,000, it must recognize a \$142,308 loss in 20X2 ( $\$50,000 + \$92,308$ ).

**52 d** – Note that the question asks for the amount of **revenue** that will be reported in 20X3, not the amount of gross profit. Total revenue on the contract was \$100,000. At the end of 20X2, construction was 37.5% complete ( $\$30,000 \div [\$30,000 + \$50,000]$ ), so the revenue recognized for 20X2 was \$37,500. At the end of 20X3, we know construction was completed because the estimated cost to complete as of the end of 20X3 was zero. Therefore, the \$62,500 remaining revenue on the contract—\$100,000 minus the \$37,500 recognized in 20X2—was recognized in 20X3.

**53 d** – Planning does not enable selection of personnel for open positions.

**54 b** – If plans are made too formal, they prevent managers from pursuing new opportunities or making necessary decisions as a result of changes in the environment from what was planned.

**55 b** – Strategic plans are long-term, and therefore the product mix for the current year is not a strategic plan.

**56 b** – The objectives of the company have to be determined before anything else can be set.

**57 c** – Evaluation of environmental issues that could affect the company's profitability is not included in a company's internal analysis process because this type of analysis is not internal, but rather a factor that uncovers external opportunities and threats.

**58 d** – Contingency planning is preparation for "what if" events that are typically external and unpredictable. It produces alternatives that will prepare the organization to respond nimbly if required. This scenario planning is particularly important for companies that can be impacted by new technologies, changing government regulations or entry of competitors into the marketplace. Even though contingency planning can be expensive because it involves developing multiple plans or alternatives, it often leads to greater savings than the cost of the planning should unforeseen events occur.

**59 c** – The contribution per machine hour for product A is  $\$95 \div 4$ , or  $\$23.75$ . The contribution per machine hour for product B is  $\$55 \div 2.5$ , or  $\$22$ . Assuming customer demand is adequate to permit the company to sell all the product A it produces, the company should produce product A because its contribution per machine hour required for production is higher than that of product B.

**60 d** – The support of top management is critical to gain the support of lower-level managers, and the support of lower-level managers is critical in order to gain the support of the affected employees. Without this support from above, the budget effort will be wasted because personnel will not take the process seriously.

**61 c** – Top management must be involved in the budgeting process and their involvement includes using the budget as a means to communicate company goals.

**62 b** – If top management sets the budget levels without any input from others in the company, those charged with fulfilling the budget goals will not will support the budget as their own.

**63 d** – The forecasted cash balance at the end of the second quarter is

Beginning cash balance	\$ 36,000
+ Cash collections 2 <sup>nd</sup> Quarter	1,300,000
– Decrease in A/P	(25,000)
– 2 <sup>nd</sup> Quarter costs & expenses	(1,200,000)
+ Depreciation included in costs & expenses	60,000
– Cash purchase of equipment	(50,000)
+ Cash received from sale of asset ( $\$35,000 + \$5,000$ )	40,000
– Repayment of notes payable	<u>(66,000)</u>
= Ending cash balance	<u>\$ 95,000</u>

**64 d** – Selling and administrative budgets should be detailed enough to be useful, including an explanation of the underlying assumptions. These assumptions should be documented so that if they are changed it will be easier to adjust the affected budget figures.

**65 b** – The sales budget is the first budget that needs to be set because the production budget and all the other budgets for the company are derived from the sales budget.

**66 a** – This sales forecast is prepared for a year. A sales forecast for a full year does not need to take into consideration seasonal sales volume fluctuations in the same way as a monthly sales forecast.

**67 d** – This question says, "In the budgeting **and planning** process . . . which one of the following should be completed first?" The strategic plan must be in place before any budgeting activities can occur. Therefore, even though the sales budget is the first **budget** that needs to be completed, in the budgeting **and planning** process the strategic plan comes before the sales budget.

**68 b** – The cash budget (also called the cash management, cash flow, or working capital budget) draws upon information from all the other budgets given as answer choices. Therefore, it should be prepared after those other budgets have been prepared.

**69 a** – The individual budgets that make up the operating and financial budgets are compiled into a budgeted income statement, balance sheet, and statement of cash flows, which is the master budget.

**70 a** – At all times, the budget covers a set number of months, quarters, or years into the future. When a rolling budget is used, the month or quarter just completed is dropped and a new month or quarter's budget is added on to the end of the budget. At the same time, the other periods in the budget can be revised to reflect any new information that has become available. Thus, the budget is continuously being updated and always covers the same amount of time in the future. This is also called a **continuous budget**.

**71 d** – Activity-based budgeting enables better identification of resource needs, enables linking of costs to outputs, and enables identification of budgetary slack. While it may reduce some planning uncertainty, reduction of planning uncertainty is not always a certainty; therefore, **d** is the best answer.

**72 b** – In zero-based budgeting, the budget starts with nothing in it and all costs need to be justified each year.

**73 b** – The flexible budget amount is the standard cost per unit multiplied by the actual production volume. The budget calls for 144,000 units at a cost of \$180,000, so the standard cost per unit is \$1.25 ( $\$180,000 \div 144,000$ ). Actual production was 10,800 units, so the flexible budget amount is \$13,500 ( $10,800 \text{ units} \times \$1.25 \text{ per unit}$ ).

**74 c** – In order to solve this problem, we need to determine a total fixed cost and the variable cost per unit. The total fixed costs are \$200,000 (\$100,000 each of manufacturing and selling costs). The total variable costs in the 100,000-unit budget are \$450,000, so the standard variable cost is \$4.50 per unit ( $\$450,000 \div 100,000 \text{ units}$ ). Therefore, to produce 110,000 units the company will incur \$495,000 in variable costs ( $\$4.50 \times 110,000 \text{ units}$ ) and \$200,000 in fixed costs for a total of \$695,000.

**75 c** – Much of the information given in this question is not needed to determine the correct answer. The shipping cost function is provided as well as the total pounds actually shipped (12,300 pounds) to use in the function. Putting this information into the formula, we get:  $\$16,000 + (\$0.50 \times 12,300) = \$22,150$ .

**76 b** – The flexible budget amount is the budgeted contribution margin per unit multiplied by the actual sales volume, minus the budgeted fixed costs. The budgeted contribution margin at a sales volume of 180,000 units is  $\$975,000 \div 150,000 \times 180,000 = \$1,170,000$ .  $\$1,170,000$  minus \$250,000 fixed overhead and minus \$500,000 fixed selling and administrative expenses equals the flexible budget net income for the month of \$420,000.

**77 c** – This question asks for the budgeted amount of direct material that needs to be purchased during the third quarter. Purchases made during the third quarter need to cover the amount required for production during the third quarter and the amount of direct materials inventory necessary to begin the fourth quarter with the required amount of 30% of the fourth quarter's usage requirement. The calculation of Purchases must also consider the amount of direct materials on hand at the beginning of the third quarter.

The basic inventory formula is: Beginning Inventory + Purchases – Usage = Ending Inventory. With three of the four amounts, the fourth can always be determined. For this question, we must calculate for Purchases. Information for the other three amounts can be derived from the information given in the question.

The beginning inventory for the third quarter is 30% of the third quarter's usage requirement. The third quarter's usage requirement is  $34,000 \times 3$ , or 102,000 units of direct materials. Thus, the beginning inventory of direct material for the third quarter is  $102,000 \times 0.30$ , or 30,600.

Third quarter usage, as calculated above, is 102,000 units of direct material.

The ending inventory for the third quarter is the same as the beginning inventory for the fourth quarter. The beginning inventory for the fourth quarter needs to be 30% of the usage requirement for the fourth quarter. Planned production for the fourth quarter is 48,000 units, so materials requirements for those will be  $48,000 \times 3$ , or 144,000 units of direct materials. Thus, the beginning inventory for the fourth quarter needs to be  $144,000 \times 0.30$ , or 43,200 units, and this is the ending inventory for the third quarter.

With three of the four amounts for the inventory formula, we can calculate Purchases for the third quarter.

Beginning Inventory + Purchases – Usage = Ending Inventory

Let P stand for Purchases. The equation is:

$$30,600 + P - 102,000 = 43,200.$$

Solving for P, we get  $P = 114,600$ .

**78 c** – The inventory formula in units, which can be used for either finished goods or direct materials inventory, is:

Beginning Inventory + Units Produced or Purchased – Units Sold or Used = Ending Inventory

With three of these amounts, we can solve for the fourth. To answer this question, we need to calculate what the production needs to be during July, August, and September in order to end the month of September with the required number of units in ending finished goods inventory.

Beginning finished goods inventory is 150,000 units. We need to calculate the number of units that will be sold during the three-month period and the ending inventory level, and then we can use Beginning Inventory, Units Sold, and Ending Inventory to calculate Units Produced.

The required ending inventory on September 30 needs to be 80% of the next month's estimated sales, so we need to determine October's budgeted sales. If July's budgeted sales are 200,000 units and the company expects a growth rate in sales of 5% per month, October's budgeted sales will be  $200,000 \times 1.05 \times 1.05 \times 1.05$ , or 231,525. Therefore, the September 30 ending finished goods inventory needs to be  $231,525 \times 0.80$ , or 185,220 units.

Sales during July, August, and September are budgeted as follows:

July budgeted sales are 200,000 units.

August budgeted sales are  $200,000 \times 1.05$ , or 210,000 units.

September budgeted sales are  $210,000 \times 1.05$ , or 220,500 units.

Therefore, the total number of units budgeted to be sold during July, August, and September is  $200,000 + 210,000 + 220,500$ , or 630,500.

Now we can calculate Berol Company's production requirement in units of finished product for the three-month period ending September 30:

Beginning Inventory + Units Produced – Units Sold = Ending Inventory

Let X stand for Units Produced. The equation is:

$$150,000 + X - 630,500 = 185,220$$

Solving for X, we get  $X = 665,720$  units that must be produced during July, August, and September.

**79 c** – We assume that July, August, and September production will be 600,000 units. Each unit requires 4 pounds of direct materials, so to produce 600,000 units, 2,400,000 pounds ( $600,000 \times 4$ ) of direct materials will be needed.

Beginning direct materials inventory is 800,000 pounds.

Ending direct materials inventory needs to be 25% of the direct materials used during the three-month period of July through September, or  $2,400,000 \text{ pounds} \times 0.25$ , which is 600,000 pounds.

Beginning Inventory + Units Purchased – Units Used in Production = Ending Inventory

Let X stand for Units Purchased. The equation is:

$$800,000 + X - 2,400,000 = 600,000$$

$X = 2,200,000$  pounds of direct materials to be purchased.

However, the question does not ask for the number of pounds to be purchased; rather, it asks for the estimated cost to purchase direct materials. The estimated cost to purchase 2,200,000 pounds of direct materials at a cost per pound of \$1.20 = \$2,640,000.

**80 b** – This is a very long question with only a few important pieces of information. In January, the production will be equal to 1.5 times the expected sales in February. Expected February sales are 36,000; therefore, in January the company will produce 54,000 units.

**81 b** – In February the production will be equal to 50% of March sales. March sales are expected to be 33,000, so February will see production of 16,500 units. The variable cost per unit is \$7 ( $\$3.50 + \$1 + \$2 + \$0.50$ ), so total variable costs will be  $16,500 \times \$7$ , or \$115,500. Adding this figure to the \$12,000 of fixed costs gives us a total production cost of \$127,500.

**82 c** – The basic inventory formula for any purpose is:

Beginning Inventory + Additions to Inventory – Inventory Used = Ending Inventory.

Beginning inventory needs to be 40% of the amount Roket expects to sell during August, or 40% of 2,500, which is 1,000 units. Ending inventory needs to be 40% of the amount Roket expects to sell during September, or 40% of 2,100, which is 840. The company expects to sell 2,500 units during August.

Letting P stand for Units Produced (additions to inventory), the formula is:

$$1,000 + P - 2,500 = 840$$

$$P = \underline{2,340}$$

2,340 tables will need to be produced during August.

**83 b** – Four table legs are required for each table produced. The basic inventory formula is:

Beginning Inventory + Additions to Inventory – Inventory Used = Ending Inventory.

August production is 1,600 tables, and 1,600 multiplied by 4 equals 6,400 table legs that will be needed for August production.

August beginning inventory is 4,200 legs.

August ending inventory is 60% of the amount required for September production. September production is 1,800 tables, and the number of table legs needed for September production will be  $1,800 \times 4$ , or 7,200 legs. Thus August ending inventory will be 60% of 7,200, or 4,320 legs.

Letting P stand for legs purchased, the formula is:

$$4,200 + P - 6,400 = 4,320$$

$$P = 6,520$$

6,520 table legs will need to be purchased during August.

**84 a** – This mathematical calculation can be performed in several ways. One method is as follows: 1,800 units will be produced and each table needs 20 minutes, so 36,000 minutes ( $1,800 \times 20$ ) will be required. 36,000 minutes divided by 60 minutes in an hour equals 600 hours required. Each employee works 160 hours a month ( $40 \text{ hours} \times 4 \text{ weeks}$ ), so 3.75 employees will be needed.

**85 d** – The first thing to do is determine the number of bicycles and tricycles to be produced because this number determines how much of component A19 is needed. Use the basic inventory formula for finished goods to determine how many bicycles and tricycles will be produced. We then will use the basic inventory formula for direct materials to find the number of units of A19 that will need to be purchased.

The basic inventory formula for any purpose is:

$$\text{Beginning Inventory} + \text{Additions to Inventory} - \text{Inventory Used} = \text{Ending Inventory}$$

For finished goods, "Additions to Inventory" means amount produced and transferred to finished goods inventory (or for a reseller, purchases) and "Inventory Used" means amount sold. For direct materials inventory, "Additions to Inventory" means Purchases and "Inventory Used" means amount used in production.

Begin with finished goods inventory. Tricycles and bicycles both use 2 units of A19, so there is no need to calculate their A19 requirements separately. Beginning inventory of tricycles is 800 and beginning inventory of bicycles is 2,150, for a total of 2,950. Sales of tricycles are 96,000 and sales of bicycles are 130,000 for a total of 226,000. Ending inventory of tricycles is 1,000 and ending inventory of bicycles is 900, for a total of 1,900.

$$\text{Beginning Inventory} + \text{Number of Units Produced} - \text{Sales} = \text{Ending Inventory}$$

$$2,950 + \text{Number of Units Produced} - 226,000 = 1,900$$

$$\text{Number of Cycles (tricycles and bicycles) Produced} = 224,950$$

Use the basic inventory formula for direct materials in order to calculate the number of units of A19 needed to be purchased.

Beginning inventory of A19 is 3,500. Each cycle requires 2 units of A19. Therefore, the number of units of A19 needed for production will be 449,900 ( $224,950 \times 2$ ). Ending inventory of A19 is 2,000.

$$\text{Beginning Inventory} + \text{Purchases} - \text{Amount Used in Production} = \text{Ending Inventory}$$

$$3,500 + \text{Purchases} - 449,900 = 2,000$$

$$\text{Purchases} = 448,400$$

The unit cost of A19 is \$1.20. Therefore, the budgeted dollar value of purchases of A19 is  $448,400 \times \$1.20$ , or \$538,080.

Note: If the number of units of A19 needed per finished unit had been different for tricycles than bicycles, we would have needed to calculate each product's production requirements separately, multiply each one by the number of A19 required, and sum the results to find the total number required for production of the two products.

**86 b** – The economic order quantity is the most economical amount to order each time an order is placed to minimize ordering costs and holding costs. The economic order quantity for B12 is 70,000 units. If Wellfleet always orders 70,000 units of B12, the number of times the company should place an order for B12s will be the total number of B12s needed for production divided by 70,000.

We calculated in the previous question that the production of bicycles will be 128,750 units and the production of tricycles will be 96,200 units. Each bicycle requires four B12s, while each tricycle requires one B12. Therefore, the total number of B12s required for production is  $(128,750 \times 4) + (96,200 \times 1) = 611,200$ . The beginning inventory of B12s is 1,200 and the ending inventory is 1,800. We can now use the basic inventory formula to determine the number of B12s to be purchased:

$$\text{Beginning Inventory} + \text{Units Purchased} - \text{Units Used in Production} = \text{Ending Inventory}$$

Let P stand for Units Purchased. The equation is:



$$1,200 + P - 611,200 = 1,800$$

$$P = 611,800$$

With 611,800 units of B12 to be purchased, we divide 611,800 by 70,000 to find the number of times Wellfleet will purchase B12s:  $611,800 \div 70,000 = 8.74$ . Therefore, 9 orders will need to be placed in order to receive the required amount of B12. The company will have a few extra units, since the division does not work out evenly. But if the company were to order only 8 times, it would not have enough B12s to complete all of its planned production for the year.

**87 c** – To calculate collections expected during the third calendar quarter, we need to analyze each month in the quarter to determine the amount of that month's sales to be collected and the amount of the previous month's sales to be collected. The company collects 50% of the credit sales in the month of the sale and 45% in the following month. Therefore, the collections during the third quarter are:

	50% of this month	45% of last month	Total
July	\$70,000	\$54,000	\$ 124,000
August	80,000	63,000	143,000
September	75,000	72,000	<u>147,000</u>
			<b><u>\$414,000</u></b>

**88 b** – This question is similar to the previous question, except for a small and critical difference. In the previous question, 50% of the sales were collected in the month of the sale, 45% in the month after, and 5% were never collected. In this question, 5% are never collected, and 60% of the amount **to be collected** is collected in the month of the sale and 40% of the amount **to be collected** is collected in the month after the sale. Notice the difference: in this question it is not 60% of the total credit sales that will be collected during the month of sale but rather 60% of the total credit sales **that will be collected** will be collected during the month of sale. It is essential to recognize which percentage of which quantity is being collected. Therefore, in December Noskey will collect 40% of 95% of the November credit sales. November credit sales were \$240,000. Of this amount, 95% or \$228,000 will be collected. Of this amount, 40% will be collected in December, or \$91,200.

**89 c** – The budgeted cash receipts in January will include the cash collected from December and January credit sales as well as the cash sales from January. January cash sales were \$60,000. Collections from December sales will be \$136,800 ( $\$360,000 \times 0.95 \times 0.4$ ), and collections from January credit sales will be \$102,600 ( $\$180,000 \times 0.95 \times 0.6$ ). In total, \$299,400 will be collected in January.

**90 c** – Since this question states that Raymar intends to maintain a minimum balance of \$100,000 at the end of each month by either borrowing for deficits below the minimum balance or investing excess cash, we must assume that the company's balance of cash at the end of March is \$100,000. Thus, the beginning balance for April is also \$100,000. The ending balance for April, before any borrowing or investing, will be the beginning balance adjusted by the month's activity.

To determine the month's activity, determine the cash collections for April: 50% of April sales and 50% of March sales (or  $\$25,000 + \$20,000 = \$45,000$ ) will be collected in April.

Next, determine the disbursements for April: 75% of April A/P and 25% of March A/P (or  $\$30,000 + \$7,500 = \$37,500$ ) will be paid on accounts payable in April. Other disbursements are paid in the month they occur, and for April they are: \$70,000 for payroll plus \$30,000 of other disbursements, totaling \$100,000 in disbursements other than accounts payable.

Total cash receipts are \$45,000 and total cash disbursements are \$137,500. Subtracting the amount of cash outflows from cash inflows, we get a \$92,500 net cash deficit in the month's activity. Therefore, the ending cash balance before any borrowing is  $\$100,000 - \$92,500$ , or \$7,500.

The company needs to increase that amount to at least \$100,000. Since borrowings for cash deficits must be made in \$10,000 increments, the company needs to borrow \$100,000 to cover the \$92,500 cash deficit and bring the ending cash balance from \$7,500 to its required minimum of \$100,000. The ending cash balance will actually be \$107,500 after \$100,000 is borrowed, but the extra \$7,500 in the cash account is unavoidable because of the \$10,000 incremental borrowing requirement.

**91 d** – In the previous question, we determined that the April ending cash balance will be \$107,500, funded by \$100,000 of borrowing.

Therefore, the company will need to pay \$1,000 of interest on May 31 ( $\$100,000 \times [12\% \div 12]$ ) for the loan that will be outstanding for the month of April.

Next, we need to determine the cash inflows and outflows for May. Cash collections in May are 50% of the April and May sales:  $(50\% \times \$50,000) + (50\% \times \$100,000) = \$75,000$ . Accounts payable paid in May are 75% of May's A/P and 25% of April A/P:  $(\$40,000 \times 75\%) + \$40,000 \times 25\% = \$40,000$ . Other disbursements total \$61,000 (\$50,000 for payroll + \$10,000 in other disbursements + \$1,000 in interest for the loan outstanding during April). After subtracting the total disbursements from the collections in May, we arrive at a \$26,000 negative cash flow  $(\$75,000 - \$40,000 - \$61,000)$ .

At the beginning of the month, the company had a cash balance of \$107,500. \$107,500 minus the \$26,000 negative net cash flow during May results in a May ending cash balance before any borrowing of \$81,500. However, the company needs to end the month with a cash balance of \$100,000; therefore, they are \$18,500 short. Since borrowings for cash deficits must be made in \$10,000 increments, the company must borrow \$20,000 to cover the \$18,500 cash deficit for May and end the month with at least \$100,000 in cash. They will thus end the month of May with \$101,500 in cash:  $\$107,500 + \$75,000 - \$40,000 - \$61,000 + \$20,000 = \$101,500$ .

**92 d** – The coefficient of correlation measures the strength of the linear relationship between two variables: the value of X (the independent) variable and the value of Y (the dependent variable).

**93 b** – The relationship between these two variables is a perfectly direct relationship. For every 1 unit that x increases, y decreases by 2 units. Since the variables move in opposite directions, this is a perfectly negative relationship, represented by  $-1$ .

**94 c** – The regression coefficient must lie between  $-1$  and  $+1$ . The closer the absolute value of the coefficient is to 1, the stronger the relationship. Among the alternatives,  $-0.89$  has the highest absolute value that is not greater than  $+1$  or less than  $-1$ .

**95 d** – Using the regression analysis formula ( $y = a + bx$ ):

$$y = 684.65 + (7.2884 \times 420)$$

$$y = 684.65 + 3061.128$$

$$y = 3745.78$$

**96 a** –  $R^2$ , the coefficient of determination, represents the percentage of the total amount of change in the dependent variable that can be explained by changes in the independent variable. In this question,  $r^2$  is given as 0.99724, or 99.724%.

**97 d** – With the cumulative average time learning model, whenever the total quantity of units produced doubles, the cumulative average time per unit required for **all** the units produced is X% of the cumulative average time per unit required at the previous production doubling-level.

This question gives labor costs instead of labor time; however, since the question also asks for total labor cost, we can use the costs in the same way that we would use time. We are told that the average labor cost for the first batch is \$120 per unit and the cumulative average labor cost after the second batch (the first doubling) is \$72 per unit. From this information, we calculate the learning curve at 60% ( $72 \div 120 = 0.6$ ). If the average cost per unit for the first two batches is \$72, then the average cost per unit for all four batches (after the fourth batch – the second doubling) is  $\$72 \times 0.6$ , or \$43.20. Since each batch contains 100 units, 4 batches contain a total of 400 units. If the average cost per unit is \$43.20, the total cost for 400 units (4 batches) is  $\$43.20 \times 400$ , or \$17,280.

**98 a** – Include the first 50 units manufactured in this analysis, since they contributed to the learning curve. Analyze the cost for the first **200** units and then subtract the cost for the first **50** units in order to calculate the cost for units numbered 51 through 200, which are the units in the second order of 150.

The first doubling takes place at unit number 100 ( $50 \times 2$ ). The second doubling will take place at unit number 200 ( $100 \times 2$ ). The total 200 units are estimated to require 2,560 hours, calculated as follows:

$$1,000 \text{ hours} \times (0.8 \times 2) \times (0.8 \times 2) = 2,560 \text{ hours for 200 units}$$

2,560 hours for 200 units less the 1,000 hours required for the first 50 units = 1,560 hours for the last 150 units.

Since variable overhead is applied on the basis of direct labor hours at \$4 per DLH, variable costs per direct labor hour are  $\$8.50 + \$4.00$ , for a total of \$12.50 per DLH.

Therefore, total costs for the 200 units are estimated at:

Direct materials: $\$1,500 \div 50 \times 200$	\$ 6,000
Direct labor & Variable OH: $2,560 \times \$12.50$	32,000
Fixed OH: 10% of total variable cost of \$38,000	<u>3,800</u>
Total cost for 200 units	\$41,800

Less: Cost for first 50 units	<u>15,400</u>
Total cost for last 150 units	<u>\$26,400</u>

**99 d** – Since production doubles twice (from 50 to 100 and from 100 to 200), the estimated number of hours required for 200 units using a 70% learning curve is:  $1,000 \text{ hours} \times (0.7 \times 2) \times (0.7 \times 2) = 1,960 \text{ hours}$ .  
 $1,960 \text{ hours required for 200 units less } 1,000 \text{ hours required for the first 50 units} = 960 \text{ hours required for the last 150 units}$ .  
 $960 \text{ hours} \div 150 \text{ units} = 6.4 \text{ average estimated hours required per unit for the last 150 units}$ .

**100 b** – Production doubles 3 times (from 1 to 2, from 2 to 4, and from 4 to 8). With the cumulative average-time learning model, the estimated total number of direct labor hours required to produce a total of eight units is  $100 \times (2 \times 0.70) \times (2 \times 0.70) \times (2 \times 0.70) = 274.4 \text{ hours}$ .

**101 c** – The expected value is a weighted average of the possible values, with the probabilities as the weights. Thus, the expected percent defective is  $(0.02 \times 0.30) + (0.03 \times 0.50) + (0.04 \times 0.20) = 0.029$  or 2.9%.

**102 d** – Risk-averse decision-makers prefer the lowest dispersion, given that the expected values are close to each other. The expected values for these two product lines are the same:  $0.2 \times 500 + 0.7 \times 300 + 0.1 \times 600 = 370$  compared with  $0.2 \times 50 + 0.7 \times 400 + 0.1 \times 800 = 370$ . The possible profits for Product X are dispersed from \$300 to \$600, whereas the possible profits for Product Y are dispersed from \$50 to \$800. Therefore, with dispersion measured as the range of possible values, the highest dispersion belongs to Product Y, so the company should choose Product X.

**103 a** – The probability of two events happening simultaneously is calculated by multiplying the probabilities of each event occurring separately:  $0.3 \times 0.5 = 0.15$ .

**104 b** – In order to determine the probability of improper operation at which Bagley would be indifferent between investigating and not investigating, determine the probability of improper operation at which the expected cost of the investigation is equal to the expected cost of not investigating.

If investigation is performed, total costs will be equal to the sum of the cost of investigation itself (\$6,000) and the expected cost of correction (\$18,000X), where "X" is the probability of improper operations. The expected cost of **not** investigating is \$33,000X. Equating both sides would allow us to find X, or the probability at which it would make no difference to Bagley whether he investigates or not. The equation is:  
 $33,000X = 6,000 + 18,000X$

To solve for X,

(1) Subtract 18,000X from both sides of the equation:

$$15,000X = 6,000$$

(2) Divide both sides of the equation by 15,000:

$$X = \underline{0.40}$$

If the probability of an improper operation is 40%, Bagley is indifferent as to whether or not he investigates.

**105 d** – The total percentage of damaged goods for Ryerson Company is equal to the sum of the damage rates for each department: Clothing ( $50\% \times 2\% = 1\%$ ), Hardware ( $30\% \times 5\% = 1.5\%$ ), Sundries ( $20\% \times 2.5\% = 0.5\%$ ). The total percentage of damaged goods is  $1\% + 1.5\% + 0.5\%$ , which equals 3%. The probability that the damage occurred in the Clothing department is  $1\% \div 3\% = 33 \frac{1}{3}\%$ .

**106 d** – To solve this problem, find the point where the number of customers leaving Firm A and going to Firm B each week is equal to the number of customers leaving Firm B and going to Firm A each week. At this intersection, there will be no further changes in the number of customers leaving firms each week. Each week, a certain number of customers will leave A and go to B, and the same number of customers will leave B and go to A. Therefore, each firm will have a certain number of customers that will not change going forward because they will each lose X number of customers each week and gain the same number of customers each week.

The total number of customers of both firms is represented by 100%, or 1. Let X stand for the decimal form of the percentage of total customers for Firm A. Conversely, Firm B's percentage of customers is  $1 - X$  (the total of the two firms' proportions must add up to 1).

Firm A will get 20% of Firm B's customers each week but lose 30% of its own customers. Therefore, the number of customers that Firm A will lose each week is  $0.3X$ , while the number of customers that Firm B will lose (and that Firm A gains) is  $0.2(1 - X)$ .



Find the point at which the number of customers that leave Firm A for Firm B is the same as the number of customers that leave Firm B for Firm A. At that point, the percentages of customers each firm has will stabilize. Therefore, find the value of  $X$  where  $0.3X$  is equal to  $0.2(1 - X)$ .

Set these two equations equal to one another and solve for  $X$ . The equation is  $0.3X = 0.2 - 0.2X$ . Solving for  $X$ , we get  $X = 0.40$ , which is the percentage of customers Firm A will have. Therefore, once A has 40% of the market and B has 60% of the market, their market shares will not change, even though customers will continue to come and go.

To validate these figures, assume that each firm begins with 100 customers (that is, 200 customers total). In the first week, 30% of Firm A's 100 customers go to Firm B; therefore, Firm A loses 30 customers and Firm B gains 30 customers. In addition, 20% of Firm B's customers go to A; therefore, Firm B loses 20 customers and Firm A gains 20 customers. As a result, Firm A has  $100 - 30 + 20 = 90$  customers and Firm B has  $100 - 20 + 30 = 110$  customers.

In the second week, 30% of Firm A's 90 customers (27) go to Firm B, and 20% of Firm B's 110 customers (22) go to Firm A. Firm A now has  $90 - 27 + 22 = 85$  customers and Firm B has  $110 - 22 + 27 = 115$  customers.

In the third week, 30% of Firm A's 85 customers (25.5) go to Firm B and 20% of Firm B's 115 customers (23) go to Firm A. Firm A now has  $85 - 25.5 + 23 = 82.5$  customers, while Firm B has  $115 - 23 + 25.5 = 117.5$  customers. (We have to use partial customers to balance this and subsequent equations, although we acknowledge that in real life there cannot be partial customers.)

In the fourth week, 30% of Firm A's 82.5 customers (24.75) go to Firm B and 20% of Firm B's 117.5 customers (23.5) go to Firm A. Firm A now has  $82.5 - 24.75 + 23.5 = 81.25$ , while Firm B has  $117.5 - 23.5 + 24.75 = 118.75$  customers.

In the fifth week, 30% of Firm A's 81.25 customers (24.375) go to Firm B and 20% of Firm B's 118.75 customers (23.75) go to Firm A. Firm A now has  $81.25 - 24.375 + 23.75 = 80.625$  customers, while Firm B has  $118.75 - 23.75 + 24.375 = 119.375$  customers.

These iterations could go on for a very long time, but from this series you should be able to see that the numbers of customers leaving Firm A and the number of customers leaving Firm B are becoming very close to one another, although the amount of change becomes smaller each week. Eventually, Firm A will have 80 customers while Firm B will have 120 customers. At that point, 30% of Firm A's 80 customers (24) will leave Firm A and 20% of Firm B's 120 customers (24) will leave Firm B each week. Firm A will have  $80 - 24 + 24 = 80$  customers and Firm B will have  $120 - 24 + 24 = 120$  customers. These cycles can go on indefinitely, but Firm A will continue to have 80 customers while Firm B will continue to have 120 customers because each gains the same number of customer as it loses each week.

Firm A has 40% of the total 200 customers ( $80 \div 200$ ), while Firm B has 60% of the total 200 customers ( $120 \div 200$ ).

If we were to calculate this proof using any other value for the beginning numbers of customers, it would end with the same result: Firm A will have 40% of the total number of customers and Firm B will have 60%.

**107 d** – The expected payoff for selling coffee is the sum of the products of individual payoffs times the probability of the corresponding states of nature:  $(0.4 \times \$1,900) + (0.6 \times \$2,000) = \$1,960$ .

**108 a** – All the shirts will be sold, but total revenue, and thus total profit, depends on the amount sold at retail (that is, before and at the game) for \$25 and the amount sold at wholesale (that is, sold to the discounter after the game) for \$10.

Expected total sales before and at the game is a weighted average of the sales at the probabilities for the various demand levels weighted according to their probabilities. However, Carson will purchase only 6,000 shirts. So at the demand level of 7,000, Carson will be able to sell only the number of shirts it has. It cannot sell 7,000 shirts. Therefore, the expected total sales before and at the game will be  $(4,000 \times 0.15) + (5,000 \times 0.20) + (6,000 \times 0.65) = 5,500$ .

Expected revenue before and at the game will thus be  $5,500 \times \$25$ , or \$137,500. The 500 shirts not sold before and at the game will be sold to the discounter for  $500 \times \$10$ , or \$5,000. Total expected revenue is thus \$142,500. The cost for 6,000 shirts at \$13 each is \$78,000. Therefore, Carson's expected profit is  $\$142,500 - \$78,000 = \$64,500$ .

**109 c** – Top management should not be involved in setting budget standards for production because this is a low-level activity best done by those more directly involved with budget-related matters.

**110 d** – Standard costing systems are often and best used together with a flexible budget. By using standard costs, the firm can prepare the flexible budgets that enable better analysis at the end of the period.

**111 b** – The total standard cost allowed for the actual output is \$60,000. Two units of raw material are allowed for each unit produced and the company produced 12,000 units. Therefore, the standard quantity allowed for the actual output is  $12,000 \times 2$ , or 24,000 units. The standard price for one unit of material is  $\$60,000 \div 24,000$  units of direct materials, or \$2.50 per unit of direct materials.

**112 d** – For this question, solve the materials quantity variance formula for AQ. The variance formula is  $(AQ - SQ) \times SP$ . SQ can be calculated because the company produced 12,000 units, and two units of raw materials are required for each unit of output. Therefore, the standard quantity for the actual output is 24,000 units. The standard price per unit of raw material can also be calculated because the standard cost allowed for the actual output is \$60,000. Since the standard quantity for the actual output is 24,000 units, the standard price per unit of raw materials is  $\$60,000 \div 24,000$ , or \$2.50. The quantity variance is \$2,500 unfavorable. Therefore, the formula is:

$$(AQ - 24,000) \times \$2.50 = \$2,500.$$

Solving for AQ, we get  $AQ = 25,000$ , as follows:

$$2.5AQ - 60,000 = 2,500$$

$$2.5AQ = 62,500$$

$$AQ = \underline{25,000}$$

**113 c** – The formula for calculating the materials price variance is  $(AP - SP) \times AQ$ . The actual price for raw materials is  $\$105,000 \div 35,000$  units in inventory, or \$3.00 per unit. The standard price is \$2.50 per unit of raw materials ( $\$60,000 \div 12,000$  units actually produced  $\div 2$  units of materials per unit produced). The Actual Quantity in the formula is the actual quantity of the raw materials that were **used** in producing the 12,000 finished units. It is not the actual quantity of product produced, nor is it the standard quantity of materials for the actual quantity produced.

To calculate the price variance, we need to know the number of units actually used in production, but the question does not provide this number. However, the question states that there is an unfavorable quantity variance of 2,500. Therefore, to determine the number of units of materials actually used, use the quantity variance formula to solve for AQ.

The quantity variance formula is  $(AQ - SQ) \times SP$ . Since the question indicates that the materials standard is 2 units of raw materials for each unit produced, the standard quantity of materials for 12,000 units is 24,000 units. The actual quantity is not yet known. The standard price is \$2.50 per unit of raw material ( $\$60,000$  standard allowed  $\div 12,000$  units actually produced  $\div 2$  units of materials per unit produced). The quantity variance is 2,500 Unfavorable. The formula is:

$$(AQ - 24,000) \times \$2.50 = \$2,500$$

Solving for AQ, we get  $AQ = 25,000$ , as follows:

$$2.5AQ - 60,000 = 2,500$$

$$2.5AQ = 62,500$$

$$AQ = 25,000$$

Now, we can input the actual quantity of materials used into the materials price variance formula and calculate the materials price variance.

$$(AP - SP) \times AQ$$

$$(\$3.00 - \$2.50) \times 25,000 = \underline{\$12,500} \text{ Unfavorable}$$

**114 b** – The price variance formula is  $(AP - SP) \times AQ$ . Entering the figures from the question into the formula, we get  $(\$0.75 - \$0.72) \times 4,100$ . The answer is an unfavorable variance of \$123. (Remember for the price variance to use the number of units **used** in production, unless the problem asks for the **purchase** price variance.)

**115 d** – The actual sales volume of the product will not impact the materials efficiency variance. The difference between sales and production does not affect the comparison of the amount of material that should have been used in the production and the amount actually used.

**116 b** – If the company has an unfavorable materials usage variance, then more materials were used than necessary. The variance in materials usage may in turn cause more labor hours in order to handle and process the additional materials. Therefore, the unfavorable materials usage variance may also cause an unfavorable labor variance.

**117 d** – To solve for the direct materials usage variance, use the following formula:  $(AQ - SQ) \times SP$ . The standard price is \$3.60 per pound and the standard quantity required to produce the actual quantity of output

is 110,000 (22,000 units × 5 pounds per unit). The actual quantity used is 108,000; therefore, the formula is  $(108,000 - 110,000) \times \$3.60 = \$ (7,200)$  Favorable.

**118 a** – To solve for the direct labor rate variance, use the following formula:  $(AP - SP) \times AQ$ . The actual quantity of labor hours is 28,000 and the standard rate is \$12.00 per hour. The actual rate is calculated by dividing the actual cost (\$327,600, which is 90% of the total labor cost) by the actual hours worked (28,000). The result is an actual labor rate of \$11.70 per hour. Inputting these numbers into the formula, we get  $(\$11.70 - \$12.00) \times 28,000 = \$ (8,400)$  Favorable.

**119 b** – To solve for the direct labor usage (efficiency) variance, use the following formula:  $(AQ - SQ) \times SP$ . The standard price is \$12.00 and the actual quantity is 28,000. The standard quantity for the actual level of output is 27,500 (22,000 units × 1.25 hours per unit). Putting these numbers into the formula, we get  $(28,000 - 27,500) \times \$12 = \$6,000$  Unfavorable.

**120 d** – In order to calculate the direct labor efficiency variance, use the following formula:  $(AQ - SQ) \times SP$ . The standard price is \$12 per direct labor hour. The standard number of hours for the level of production is 6,500 (5,200 units × 1.25 hours per unit). The actual number of hours used is 6,600. Putting these numbers into the formula, we get  $(6,600 - 6,500) \times \$12 = \$1,200$  Unfavorable. The variance is unfavorable because it is a positive amount for a cost item.

**121 d** – The materials mix variance equals the actual total quantity used times the difference between the weighted average standard price for the actual mix per unit and the weighted average standard price for the standard mix per unit. The weighted average standard price for the actual mix is  $(21,000 \times \$0.75) + (14,000 \times \$0.90) = \$28,350$ . Therefore, the weighted average standard price for the actual mix per unit is \$0.81  $(\$28,350 \div 35,000 \text{ kg})$ . The weighted average standard price for the standard mix is \$0.80 per unit.  $(\$240 \text{ standard total cost per batch} \div 300 \text{ standard total kg per batch})$ . The mix variance is  $(\$0.81 - \$0.80) \times 35,000 = \$350$  Unfavorable.

**122 b** – The materials yield variance equals the weighted average standard price for the standard mix per unit multiplied by the difference between the actual total quantity used and the standard total quantity for the actual output achieved. The weighted average standard price for the standard mix is \$0.80 per kg.  $(\$240 \text{ standard total cost per batch} \div 300 \text{ standard total kg per batch})$ . The actual total quantity used is 35,000. The standard total quantity for the actual output achieved is  $300 \text{ kg per batch} \times 110 \text{ batches} = 33,000 \text{ kg}$ . Therefore, the yield variance is  $(35,000 - 33,000) \times \$0.80 = \$1,600$  Unfavorable.

**123 b** – The variable overhead efficiency variance is essentially a quantity variance, and it determines the amount of the total variance caused by a different usage of the allocation base than was expected (that is, the standard hours allowed for the actual output).

The variable overhead efficiency variance is closely related to efficiency or inefficiency in the use of whatever allocation base is used to apply the variable overhead. For example, if variable overhead is applied on the basis of direct labor hours, the variable overhead efficiency variance will be unfavorable when the direct labor efficiency variance is unfavorable and vice versa.

The variable overhead efficiency variance is:

Budgeted VOH based on actual usage – Variable OH applied to production

Or:

$$(AQ - SQ) \times SP$$

Where: AQ is the actual quantity of the variable overhead allocation base (direct labor hours or direct machine hours) used for the actual output,

SQ is the standard quantity of the variable overhead allocation base allowed for the actual output, and

SP is the standard variable overhead application rate.

The direct labor efficiency variance is:

$$(AQ - SQ) \times SP$$

Where: AQ is the actual hours used,

SQ is the standard hours used for the actual output, and

SP is the standard direct labor rate

Note that when variable overhead is applied on the basis of direct labor hours, "AQ" and "SQ" are the same amounts in both the variable overhead efficiency variance and the direct labor efficiency variance. Thus, when variable overhead is applied on the basis of direct labor hours and the direct labor efficiency variance is favorable, the variable overhead efficiency variance will also be favorable and vice versa.

**124 a** – The production-volume variance (or the volume variance) is the flexible/static budgeted fixed overhead minus the amount of fixed overhead applied. The flexible/static budget fixed overhead amount is given as \$400,000.

The predetermined application rate for fixed overhead is  $\$400,000 \div 10,000 \text{ DLH}$ , or \$40 per DLH.

With standard costing, overhead is applied to production on the basis of the amount of the application base that is **allowed** for the actual output. The amount of DLH allowed for the actual output is 9,900 hours.

Therefore, the amount of fixed overhead applied to production is \$40 per DLH multiplied by the amount of DLH allowed for the actual output, which is 9,900 hours. So the fixed overhead applied is \$396,000.

The Volume Variance is  $\$400,000 - \$396,000$ , which equals \$4,000. Since the amount is positive, the variance is unfavorable. It is unfavorable because it means the facilities were not used to the extent planned.

**125 b** – The total fixed overhead variance is the difference between the actual total fixed overhead cost incurred and the applied fixed overhead. It is the amount of the under-applied or over-applied fixed overhead costs.

**126 c** – The fixed overhead volume variance results from a difference between actual and budgeted production. Unlike other variances, the fixed overhead production-volume variance (or the volume variance) does not relate to an expenditure problem in which either too much is paid or too much is used. Therefore, the fixed overhead volume variance is the least significant variance for cost control.

**127 b** – Two standard direct labor hours are allowed for each unit. Since Franklin Glass Works produced 198,000 units, the standard total hours should be 396,000 ( $198,000 \times 2$ ).

**128 a** – To solve for the variable overhead efficiency variance, use the following equation:  $(AQ - SQ) \times SP$ , where AQ is the actual quantity of the direct labor hours used, SQ is the standard quantity of direct labor hours allowed for the actual output, and SP is the standard variable overhead application rate.

In order to calculate the standard variable overhead allocation rate (the "SP" in the formula), determine the total variable overhead that was budgeted. The **total** budgeted overhead is \$900,000 and the **fixed** overhead is \$3 per unit. Since 200,000 units are budgeted for production, the total budgeted fixed overhead is \$600,000 ( $200,000 \times \$3$ ). Therefore, the budgeted variable overhead is \$300,000 ( $\$900,000 - \$600,000$ ). Since 200,000 units were budgeted and 2 direct labor hours are allowed per unit, 400,000 direct labor hours were budgeted. Calculating the allocation rate, we get \$0.75 of variable overhead allocated per direct labor hour ( $\$300,000 \div 400,000 \text{ hours}$ ).

The actual number of direct labor hours is 440,000 and the standard number of direct labor hours allowed for the actual production is 396,000 (198,000 units actually produced multiplied by 2 direct labor hours allowed per unit produced). Therefore, the formula is:  $(440,000 - 396,000) \times \$0.75$  and the variance is an unfavorable \$33,000.

**129 c** – To solve for the variable overhead spending variance, use the following equation:  $(AP - SP) \times AQ$ , where AP is the actual variable overhead cost per direct labor hour, SP is the standard variable overhead allocation rate per direct labor hour, and SQ is the actual quantity of direct labor hours used for the actual output.

The SP, the variable overhead allocation rate per direct labor hour, is \$0.75 (calculated in the previous question).

The AP is calculated as the actual variable overhead  $\div$  actual direct labor hours. The actual variable overhead is \$352,000 and 440,000 direct labor hours were actually used. Thus, the AP is  $\$352,000 \div 440,000 = \$0.80$  per direct labor hour.

Therefore, the formula is:  $(\$0.80 - \$0.75) \times 440,000$ . The variance is an unfavorable \$22,000.

**130 b** – To solve for the fixed overhead spending variance, subtract budgeted fixed overheads from the actual fixed overheads incurred. The actual fixed overheads are \$575,000 and the budgeted fixed overheads are \$600,000 (as calculated for the question above). Therefore, the fixed overhead spending variance is  $\$575,000 - \$600,000 = \$(25,000)$ , a favorable variance.

**131 c** – The amount of fixed overhead applied is calculated as the application rate (\$3 per unit) multiplied by the number of units produced (198,000). Fixed overhead applied is \$594,000.

**132 a** – The fixed overhead volume variance is calculated as the budgeted fixed overhead minus the applied fixed overhead, and a positive amount is unfavorable because it means production volume was lower than planned. The budgeted fixed overhead is \$600,000 (calculated for a previous question) and the applied amount is \$594,000 (also calculated for a previous question), so the fixed overhead volume variance is an unfavorable \$6,000.

**133 a** – This question asks for the selling price variance, meaning the flexible budget variance for sales revenue. The actual sales price is \$11.50 ( $\$92,000 \div 8,000$ ) and the standard (budgeted) price is \$10.50 ( $\$105,000 \div 10,000$ ). Inputting these figures into the formula  $(AP - SP) \times AQ$  (with 8,000 as the actual quantity), we get  $(11.50 - 10.50) \times 8,000 = 8,000$ . Since this is an income item, a positive variance is favorable.

**134 b** – This question asks for the sales volume variance for operating income. As a reminder, the sales volume variance can be calculated for any line on the income statement. The term “sales” does not refer exclusively to the revenue line. When the question does not specify which line the sales volume variance should be calculated for, assume that it refers to operating income.

There are two ways to calculate the sales volume variance for operating income. The first way is to calculate the sales volume variance for the contribution margin line because that is the same as the sales volume variance for net operating income. The second way is to subtract the Static Budget Operating Income from the Flexible Budget Operating Income.

To calculate the sales volume variance for the contribution margin line, compare actual quantity to the static budget quantity. The formula is  $(AQ - SQ) \times SP$ , with the budgeted contribution margin per unit used for SP. The budgeted contribution margin per unit is \$10 (calculated either as  $\$120,000 \text{ Static Budget CM} \div 12,000 \text{ Static Budget units sold}$  or  $\$110,000 \text{ Flexible Budget CM} \div 11,000 \text{ Actual and Flexible Budget units sold}$ ). The actual quantity is 11,000 and the standard quantity is 12,000. Therefore, the variance formula is:  $(11,000 - 12,000) \times \$10 = \$(10,000)$  Unfavorable.

We can also subtract the Static Budget Operating Income from the Flexible Budget Operating Income, as follows:  $\$38,000 - \$48,000 = \$(10,000)$  Unfavorable.

**135 d** – For a single-product firm, calculate flexible budget amounts for variable lines by dividing the static budget variable amount by the static budget number of units to be sold to get the budgeted amount per unit, and then multiply that figure by the actual number of units sold. In the static or master budget, the contribution per unit is \$4 per unit ( $\$40,000 \div 10,000 \text{ units}$ ). Therefore, if we actually sold 12,000 units, we would expect the contribution margin to be \$48,000 ( $\$4 \times 12,000 \text{ units}$ ), and this is the flexible budget amount for the contribution margin. Next, subtract budgeted fixed costs of \$30,000 (which do not change from the static budget amount) to get a flexible budget operating income of \$18,000 at a sales level of 12,000 units.

**136 c** – The sales volume variance for operating income is the same as the sales volume variance for the contribution margin line and is calculated as  $(AQ - SQ) \times SP$ , where SP is the standard (or budgeted) contribution margin per unit. The sales volume variance for operating income can also be calculated by subtracting the Static Budget Operating Income from the Flexible Budget Operating Income.

Using the formula  $(AQ - SQ) \times SP$  to calculate the sales volume variance for the contribution margin line, the actual quantity is 12,000 and the standard quantity is 10,000. The standard contribution margin per unit (SP) is \$4 ( $\$40,000 \div 10,000 \text{ units}$ ). This gives a favorable sales volume variance of \$8,000:  $(12,000 - 10,000) \times \$4$ . This is also the sales volume variance for operating income. The sales volume variance for the contribution margin and the sales volume variance for operating income are the same since the sales volume variance for fixed costs is zero.

The sales volume variance for operating income can also be calculated by subtracting the static budget operating income of \$10,000 from the flexible budget operating income of \$18,000, as calculated in the previous question:  $\$18,000 - \$10,000 = \$8,000$  Favorable.

**137 a** – The sales quantity variance formula is  $(AQ - SQ) \times SP$ . For the contribution margin, the “SP” in the formula is the contribution margin per unit. The standard contribution margin is \$2.50 per unit ( $\$6 - \$3.50$ ). Given an actual quantity of 42,000 units and a standard quantity of 40,000 units, we get a favorable sales quantity variance of \$5,000:  $(42,000 - 40,000) \times 2.50 = \$5,000$ . Since this is a positive amount for a line that increases net operating income, it is a favorable variance.

**138 c** – The stand-alone cost allocation method determines the weights for cost allocation by considering each user of the cost as a separate entity. When the stand-alone method is used, total common costs are distributed among the operating units based on each unit’s proportion of the entire organization, using an appropriate basis.

**139 a** – This question focuses on **product costs** that are **under the control of the warehouse supervisor**. The supervisor controls both receiving and shipping, but shipping is a selling cost. Thus shipping is a period cost that is expensed in the period in which it is incurred, so shipping costs are not product costs. Therefore, the costs for the shipping department are not part of the answer, even though they are controllable by the warehouse supervisor. The supervisor’s salary is not controlled by the supervisor, so that is not a part of the answer, either. The labor-related product costs that the supervisor can control include only the wages and benefits of the receiving department. The receiving clerks’ wages are \$75,000 and their



benefits are 30% of this amount (\$22,500). Therefore, the supervisor controls \$97,500 of costs (\$75,000 + \$22,500).

**140 c** – It is important that managers in an organization are evaluated only on what they can control. It is not fair to evaluate managers on things they are not able to control.

**141 d** – In evaluating segment performance and the segment manager's performance, it is important to distinguish between the performance of the manager and the performance of the segment the manager manages. On a contribution income statement by segment, direct fixed costs controllable by others are the same as non-controllable traceable fixed costs. Costs that are traceable to a segment but controlled by someone other than the segment manager are used in evaluating the performance of the segment, but they should not be used in evaluating the performance of the segment manager.

**142 a** – Contribution margin is calculated as sales revenue minus the variable costs for the units sold. The sales price is \$100 per unit and the variable costs total \$72 per unit: DM - \$30; DL - \$20; other variable manufacturing costs - \$10; Variable selling costs - \$12. Thus, contribution is \$28 per unit (\$100 - \$72). 900 units were sold, giving a contribution margin of \$25,200.

**143 d** – Transfer prices based on actual costs can lead to suboptimal decisions for the company as a whole because when the transfer price is based on actual costs, there is no incentive for the producer to control costs. As a result, costs incurred by the producing division may be higher than necessary, and therefore the senior management of the company may make decisions that are not best for the company as a whole. (Transfer prices do not charge inefficiencies to the department that is **transferring** the goods but rather to the department that **purchases** the goods.)

**144 d** – Given that Division Z is producing at only 60% of its capacity and thus has unused capacity, to maximize total company profits and be most equitable to the managers of Division both divisions, the transfer price should be between the variable costs of production (\$12) and the market price (\$20). \$18 is the only option between these amounts.

**145 d** – When operating below capacity, the **minimum** transfer price the producing department will sell for internally is its variable cost of production, which is \$7 per unit.

**146 b** – Because the alpha division is operating at capacity, the **minimum** price it will charge an internal division is the market price. The market price per unit is \$50.

**147 d** – The market price is \$200 per ton plus \$20 per ton transportation-in, for a total of \$220 per ton. Since the transfer price is equal to the market price, this is market-based transfer pricing.

**148 d** – The ROI for a division is calculated as its operating income divided by its average invested assets. In this problem, average invested assets includes the property, plant and equipment (\$1,775,000) and the working capital (\$625,000). This makes the division's total average investment \$2,400,000. The division's operating income is calculated as sales minus expenses, or \$4,000,000 net sales - \$3,525,000 COGS - \$75,000 G&A = \$400,000. The ROI is \$400,000 ÷ \$2,400,000, or 16.67%.

**149 d** – When a company reports operating results according to responsibility center, each responsibility center's report contains a partial balance sheet showing the assets under its control, the liabilities incurred for the purchase of those assets, and an operating income statement showing the responsibility center's revenues and expenses. However, shareholders' equity does not appear on the individual responsibility center balance sheets because equity belongs to the whole corporation. Equity cannot be divided up among responsibility centers, and it cannot be affected by any decision made by any individual responsibility center manager.

Since no individual responsibility center has any equity on its balance sheet, no individual responsibility center manager has any authority to determine how equity should be raised. Decisions about raising equity to finance capital investments (that is, sale of new common or preferred stock or the use of retained earnings) can be made only by senior management.

Therefore, the operating decisions made by the individual division managers affect the total assets employed by their divisions, the working capital they have to work with, and the total assets they have available to them (whether the assets are employed or not). The operating decisions made by the individual division managers cannot affect shareholders' equity.

**150 b** – To solve this problem, set up a basic ROI using any numbers. For example, use operating income of \$100,000 (\$500,000 sales revenue - \$400 expenses) ÷ investment of \$400,000 = ROI of 0.25. Then go through the answer choices, changing the amounts as outlined in each answer choice to find the answer choice that results in an increased ROI, as follows:

Answer a: Sales revenue and expenses both increase by \$50,000 (thus operating income remains the same) while total investment increases by the same amount. (\$550,000 sales revenue - \$450,000 expenses) ÷ investment of \$450,000 will result in a decreased ROI (to 0.222 from the current 0.25) because the numerator remains the same while the denominator increases.

Answer b: Sales revenue remains the same (\$500,000) while expenses are reduced by the same amount by which total investment increases. Using a decrease in expenses of \$50,000 and an increase in investment of \$50,000, ROI increases:  $(\$500,000 \text{ sales} - \$350,000 \text{ expenses}) \div \$450,000 \text{ investment} = \text{ROI of } 0.333$ , an increase from the current 0.25.

There is no need to go further, because answer b fulfills the requirement of increasing ROI and thus is the correct answer. However, for illustration purposes, here are examples of the other two answer choices:

Answer c: Sales revenue decreases by \$25,000 and expenses increase by \$25,000:  $(\$475,000 \text{ sales revenue} - \$425,000 \text{ expenses}) \div \$400,000 \text{ investment (unchanged)} = \text{ROI of } 0.125$ , a decrease from the current 0.25.

Answer d: Sales and expenses increase by the same percentage that investment increases: Using 10% increases, sales revenue increases to \$550,000  $(\$500,000 \times 1.10)$ ; expenses increase to \$440,000  $(\$400,000 \times 1.10)$ ; and investment increases to \$440,000  $(\$400,000 \times 1.10)$ . ROI is unchanged at  $(\$550,000 - \$440,000) \div \$440,000$ , or 0.25.

**151 c** – Return on investment is operating income divided by assets. North's ROI is  $\$1,000 \div \$2,500$  or 0.40; East's ROI is  $\$5,000 \div \$15,000$  or 0.333; South's ROI is  $\$4,000 \div \$8,000$  or 0.50; and West's ROI is  $\$7,500 \div \$25,000$  or 0.30. South's return on investment is the highest of the four.

**152 d** – Residual income is the excess of income over the target level of income. The target for Zack is 10% of the invested assets (\$200,000), or \$20,000. Since Zack's operating income is \$50,000, Zack has residual income of \$30,000  $(\$50,000 - \$20,000)$ .

**153 c** – The target return on investment used in calculating Residual Income is an **imputed** interest rate. In this context, "imputed" means "implied," "attributed," or "assigned." The target return is an interest rate that management assigns. It is not a cash interest charge but rather it is an interest charge that is assigned for the purpose of analysis.

**154 b** – Because residual income focuses on an absolute amount of return, use of RI for performance evaluation will prevent the manager of a division with a high current return on investment from rejecting an investment that would be profitable in terms of increasing shareholder wealth but simply has a lower rate of return on investment than desired.

**155 a** – If the expected rate of return on a new investment is greater than the required rate of return (usually the cost of capital), residual income will increase, even if the expected return on the new investment is lower than the current return on investment.

**156 c** – Customer returns, manufacturing throughput time, and training hours are all non-financial measurements that could be used in a balanced scorecard. Return on investment is a financial measurement, and number of manufacturing plants is not a meaningful metric.

**157 a** – To calculate the customer-level operating profit per unit sold for each customer, we need to consider only relevant revenues and costs. Relevant revenues and costs are those revenues and costs that would cease to exist if a customer were no longer making purchases. Once the customer-level operating profit is calculated, dividing each customer's operating profit by the number of units sold to that customer results in the operating profit per unit sold for each customer. Relevant revenues and costs are: sales, cost of goods sold, delivery cost and order taking cost. Those revenues and costs would go away if the customer were no longer a customer. Administration, depreciation and utilities costs would continue. Thus, the customer-level operating profit per unit sold for each of the four customers is as follows:

	<u>Customer A</u>	<u>Customer B</u>	<u>Customer C</u>	<u>Customer D</u>
Sales	\$100,000	\$150,000	\$200,000	\$250,000
Cost of goods sold	50,000	60,000	70,000	75,000
Delivery cost	10,000	25,000	30,000	50,000
Order taking	<u>15,000</u>	<u>20,000</u>	<u>25,000</u>	<u>30,000</u>
Customer-level operating profit	\$ 25,000	\$ 45,000	\$75,000	\$ 95,000
Divided by number of units sold	10,000	20,000	35,000	50,000
Equals customer-level operating profit per unit sold	\$2.50	\$2.25	\$2.14	\$1.90

The customer with the highest customer-level operating profit per unit sold is Customer A.

